Monongahela National Forest

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Final
Environmental Impact Statement
for
Forest Plan Revision

Final Environmental Impact Statement for the Monongahela National Forest Forest Plan Revision

September, 2006

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Abstract

In July 2005, the Forest Service released for public review and comment a Draft Environmental Impact Statement (DEIS) that described four alternatives for managing the Monongahela National Forest. Alternative 2 was the Preferred Alternative in the DEIS and was the foundation for the Proposed Revised Forest Plan. Alternative 2 was modified for the Final Environmental Impact Statement (FEIS) to address public comments and new information received since the release of the DEIS. A fifth alternative, Alternative 2 Modified (or Alternative 2M), was the result. Alternative 2M is the Preferred Alternative in the FEIS and the foundation for the 2006 Revised Land and Resource Management Plan for the Monongahela National Forest.

This FEIS documents the analysis of the five alternatives developed for the programmatic management of the Monongahela National Forest. The Selected Alternative in the Record of Decision that accompanies this FEIS will be the 2006 Forest Plan that guides all natural resource management activities on the Forest, addresses new information and concerns raised since the 1986 Forest Plan was released, and meets the intent of all applicable federal laws, regulations, and agency policies.

The Selected Alternative, and the rationale for its selection, are described in the Record of Decision for this FEIS.

Preface

The Monongahela National Forest (MNF) was founded in 1920 to help recover lands ravaged by uncontrolled logging, fire, and floods. The U.S. government established a "proclamation boundary" within which parcels of land could be purchased to increase the size and benefits of the Forest. The MNF is now more than 919,000 acres of National Forest System lands located in east central West Virginia. The USDA Forest Service administers the MNF, aided by other agencies, cooperators, contractors, and concessionaires. Forest personnel practice multiple-use natural resource management, providing West Virginia and the surrounding region with wood products, natural gas, improving watersheds, a wide range of recreation opportunities, diverse habitat for wildlife, and protection of unique ecological and wilderness areas.

Under the Multiple-Use Sustained-Yield Act of 1960 and the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976 (NFMA), National Forest System lands are managed for a variety of uses on a sustained yield basis to ensure a continued supply of goods and services. The NFMA specifies that forest plans will be developed for all national forests and should be revised at least every 15 years. The original Land and Resource Management Plan for the Monongahela National Forest was approved in 1986, and since then there have been changes in Forest conditions, laws and policies, public interests, science and technology, and in the way we implement and monitor activities on the Forest. These combined factors are the basis for revision of the Forest Plan.

Following direction from the National Environmental Policy Act, the Forest Service has prepared this FEIS for the revision of the 1986 Forest Plan. The FEIS provides the purpose and need for Plan revision, presents issues addressed, describes management alternatives considered to respond to those issues, and analyzes the potential environmental effects of the alternatives.

The MNF 2006 Land and Resource Management Plan (2006 Forest Plan) accompanies this FEIS and is based on the Preferred Alternative that is described in Chapter 2 of the FEIS. The 2006 Forest Plan describes desired conditions, assigns goals and objectives, and provides standards and guidelines related to achieving the desired conditions. The 2006 Plan also establishes Management Prescription areas that emphasize certain types of management activities and uses, and it outlines a program for monitoring and evaluating the results of plan implementation.

The FEIS is organized into the following chapters and appendices:

Chapter 1 – Purpose and Need of the Proposed Action describes the need for change, decisions made in the Forest Plan, and the issues associated with Plan revision.

Chapter 2 – Alternatives Considered describes the process used to develop alternatives, lists important elements common to all alternatives, depicts each alternative considered in detail, explains why some alternatives were not considered in detail, provides a summary comparison of the potential environmental effects of the alternatives, and identifies a Preferred Alternative.

Chapter 3 – Affected Environment and Environmental Effects provides the existing condition of the physical, biological, social, and economic resources and discloses potential environmental effects of the five alternatives on those resources in a comparative format. The resources are closely tied to the issues discussed in Chapter 1.

Chapter 4 – List of Preparers lists those who participated in preparation of the DEIS or FEIS.

Chapter 7 – Index is an index of key terms used in the FEIS and where to find them.

Appendix A – Public Involvement and Recipients of the DEIS provides a description of the public involvement process associated with preparing the FEIS, and the list of agencies, organizations, and individuals who received the DEIS for review and comment.

Appendix B – Analysis Processes discusses the primary processes used in determining the outputs and effects associated with the timber and socio-economic resources.

Appendix C – Roadless Area Inventory and Wilderness Evaluation describes the process used for determining Inventoried Roadless Areas on the Forest and provides the information used to evaluate those areas for their wilderness potential.

Appendix D - Terrestrial Species Viability Evaluation lists the terrestrial species that were evaluated for viability concerns during the Plan revision process and shows the criteria that were used to evaluate them.

Appendix E - Aquatic Species Viability Evaluation lists the aquatic species that were evaluated for viability concerns during the Plan revision process and shows the criteria that were used to evaluate them.

Appendix F – References lists the literature cited in the preparation of the FEIS.

Appendix G – Glossary defines terms and acronyms used in the FEIS.

Appendix H – Biological Assessment for Threatened and Endangered Species provides the detailed evaluation of potential effects to federally threatened and endangered species, including a determination of effects for each species relative to the Preferred Alternative.

Appendix I – Responses to Comments summarizes the public comments received on the DEIS and Proposed Revised Forest Plan, along with the Forest Service responses. The comments are presented in the form of public concern statements.

Table of Contents

Chapter 1 – Purpose and Need of the Proposed Action

Chapter 2 – Alternatives Considered

Chapter 3 – Affected Environment and Environmental Effects

Chapter 4 – List of Preparers

Chapter 5 – Index

Chapter 1

Purpose and Need of the Proposed Action

Table of Contents

Page No.

Changes to Chapter 1 Between the Draft and Final EIS

Purpose and Need - We added a list of decision criteria to help clarify how the Preferred Alternative was ultimately chosen.

Issues Analyzed in Detail – We revised some of the issue indicators to make them more consistent with those found in Chapter 3.

Issues Not Analyzed in Detail – We expanded the description for Candidate Research Natural Areas to clarify which areas have been retained and which have been added in the transition from the 1986 Plan to the 2006 Plan.

THE PROPOSED ACTION

The Forest Service proposes to revise the Land and Resource Management Plan (hereafter referred to as "Forest Plan" or the "2006 Plan") for the Monongahela National Forest. The Forest Plan was originally approved and released in 1986, and includes 6 significant amendments that have occurred since. The 2006 Forest Plan establishes direction for managing resources on National Forest System lands within the proclaimed boundaries of the Monongahela National Forest.

This Final Environmental Impact Statement (FEIS or Final EIS) describes four alternatives for revising the Forest Plan and discloses the potential environmental effects of these alternatives. The FEIS is guided by the implementing regulations of the National Environmental Policy Act (NEPA) found in the Council of Environmental Quality Regulations, Title 40, Code of Federal Regulations, Part 1500. The companion document to this FEIS is the 2006 Forest Plan, a detailed presentation of the preferred alternative described in Chapter 2 of this FEIS.

FOREST PLAN DECISIONS

National Forest System management decisions are made in two stages. The first stage is the Forest Plan, which establishes direction and prescription areas that guide the overall management and allocation of resources and land conditions on the Forest. The second stage is the analysis and approval of project proposals at a more site-specific level.

The Forest Plan does not compel the agency to undertake any site-specific project; rather it provides goals and objectives for the Forest to strive to meet in order to achieve desired physical, biological, social, and economic conditions. The Forest Plan also establishes limitations on what actions may be authorized, and what conditions must be met, during project-level decision making.

The authorization of site-specific actions within the Forest Plan area occurs through project decision making, which is the implementation stage of forest planning. Project decisions must comply with NEPA procedures and must be consistent with the Forest Plan.

The six key decisions made in forest planning for long-term management of the Forest are:

1) Establishment of Forest-wide multiple-use goals and objectives, including a description of the desired future condition of the Forest (36 CFR 219.11[b]).
2) Establishment of Forest-wide standards and guidelines to fulfill the requirements of 16 USC 1604 (NFMA) applying to future activities (36 CFR 219.13 to 219.27).
3) Establishment of management areas and direction applying to future activities in those management areas (36 CFR 219.11[C]).
4) Identification of lands not suited for timber production (16 USC 1604[k] and 36 CFR 219.14) and the allowable sale quantity (ASQ) determination for timber that may be sold from the suited timber base during each decade (36 CFR 219.16[a]).
5) Establishment of monitoring and evaluation requirements that will provide a basis for a periodic determination of the effects of management practices (36 CFR 219.11[d]).

6) Recommendation to Congress of areas for wilderness classification where 36 CFR 219.17(a) applies.

The 2006 Forest Plan includes much of the direction and many of the prescriptions found in the 1986 Plan and its amendments. The 2006 Plan also proposes new direction and management prescriptions, based on the Need For Change described in this chapter. The 2006 Plan will replace the 1986 Plan and amendments once the Responsible Official signs the Record Of Decision for this plan revision.

THE RESPONSIBLE OFFICIAL

The Regional Forester is the responsible official for the analysis and decisions in this Forest Plan revision. Conducting analysis, developing alternatives, and preparing the FEIS were done at the local Forest level under the direction of the Monongahela Forest Supervisor. Based on the analysis in the FEIS, the Regional Forester has identified a preferred alternative to become the 2006 Forest Plan. This alternative includes the six key Forest Plan decisions noted above.

FOREST PROFILE

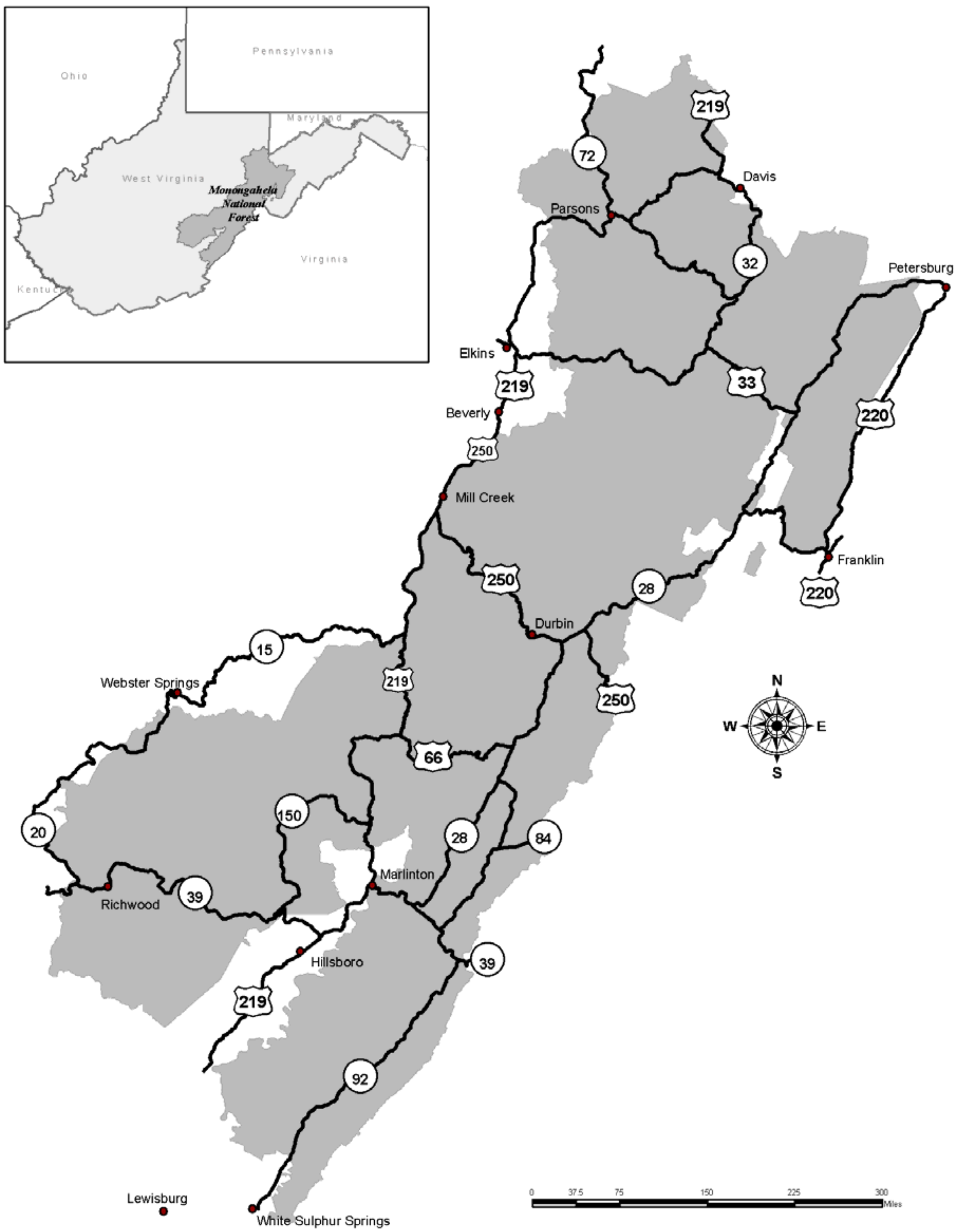
The Monongahela National Forest comprises over 919,000 acres of National Forest System lands in West Virginia. It is by far the largest expanse of public land in the State. The Forest is located primarily in Grant, Greenbrier, Nicholas, Pendleton, Pocahontas, Randolph, Tucker, and Webster Counties, with minor portions in Barbour and Preston Counties. It is administratively divided into four Ranger Districts: Cheat-Potomac, Gauley, Greenbrier, and Marlinton-White Sulphur Springs. The Forest lies within 400 miles of an estimated 96,000,000 people.

The geology of the area features steep north-south mountain ridges and deep river valleys, with elevations ranging from 900 feet near Petersburg to 4,863 feet atop Spruce Knob, West Virginia's highest point. Temperatures can vary from near 100 degrees Fahrenheit in summer to well below zero in winter. Annual precipitation ranges from about 60 inches on the west side of the Forest to less than half that amount on parts of the east side.

The headwaters of six major rivers—the Cheat, Elk, Gauley, Greenbrier, Potomac, and Tygarts Valley—are found on the Forest, as well as four impounded lakes—Lake Sherwood, Lake Buffalo, Summit Lake, and Spruce Knob Lake. The Forest has an estimated 600 miles of coldwater streams, providing more than 90 percent of the high-quality trout waters in the State. Many communities use water that flows from the Forest for all or part of their water supplies.

Due to its geographic location, elevation range, and complex geology, the Forest has great vegetative diversity. There are over 70 species of trees, mostly hardwoods, but conifer species add to the visual variety. Many of the tree species have high value for timber sawlogs and other products. The Forest offers and sells timber for harvest as a way to help achieve vegetation and habitat objectives and support local and regional economies.

Figure 1-1. Vicinity Map for the Monongahela National Forest



Many rare plants and plant communities are found on the Forest, with some at their northern- or southern-most limit of their ranges. Currently 4 plant species are listed by the US Fish and Wildlife Service as threatened or endangered. There are 17 Botanical Areas established on the Forest, and rare plants or communities are also protected in seven National Natural Landmarks, three Scenic Areas, four candidate Research Natural Areas, and five Wildernesses.

The Forest has 10 or less reported wildfires each year, with the average size less than an acre. Over 90 percent of the reported or suppressed fires are human-caused. Research indicates that fire played an important role in maintaining plant communities in fire-adapted portions of the Forest. Major insect pests include the gypsy moth and hemlock wooly adelgid. The major disease concern at present on the Forest is beech bark disease complex.

The Forest provides habitat for hundreds of animal species—including reptiles, amphibians, birds, and mammals—and an estimated 87 fish species. Currently, 5 of the wildlife species are currently listed as threatened or endangered. The Forest affords excellent opportunities for wildlife viewing, hunting, and fishing. About 7,000 acres on the Forest are open to permitted livestock grazing.

The 57,200-acre Spruce Knob-Seneca Rocks National Recreation Area is a major recreation attraction. Developed recreation opportunities are offered at over 40 campgrounds and picnic areas across the Forest. There are over 850 miles of hiking trails, including the Allegheny National Recreation Trail and the Greenbrier Historic Trail. The Forest manages five designated Wildernesses, totaling over 78,000 acres. In addition, many large backcountry areas provide semi-primitive recreation opportunities. Three Scenic Areas—Dolly Sods, Gaudineer, and Falls of Hills Creek—offer a variety of visual attractions in natural settings.

The Forest provides the setting for 40-50 natural gas wells and a natural gas storage field, which are regionally important energy sources. Other mineral resources include commercial quantities of coal, limestone, and gravel. Limestone geologies also contain numerous caves that are popular for recreation, and some that provide habitat for rare species.

The Forest transportation network has an estimated 1,752 miles of classified roads that range from paved highways to non-surfaced roads designed for high clearance vehicles. Many of these roads are available for pleasure driving, the removal of forest products, bicycling, and scenic viewing. Others are closed for resource protection or management reasons. The Forest is accessed by U.S. Highways 33, 219, and 250, and by State Routes 4, 28, 39, and 92.

PURPOSE AND NEED FOR THE PROPOSED ACTION

Purpose

The purpose of the Proposed Action is to provide a revised Plan that will:

- Guide resource management activities on the Forest,
- Address changed conditions and direction since the 1986 plan was released,
- Emphasize adaptive management over the long term,

- Meet the objectives and requirements of federal laws, regulations, and policies,
- Maintain or restore long-term ecosystem and watershed health and integrity,
- Contribute to the economic and social needs of people, cultures, and communities,
- Provide consistent direction at the Forest level that will assist managers in making project decisions at a local level in the context of broader ecological and social considerations.

Management direction and monitoring in the 2006 Forest Plan is designed to meet the purpose statements above. Overall management emphasis will largely be determined by selecting a management alternative that best achieves a combination of the following decision criteria:

- The extent the alternative maintains or restores water quality and the soil productivity necessary to support ecological functions in upland, riparian, and aquatic areas.

- The extent the alternative maintains or restores plant and animal diversity and provides habitats needed to sustain viable populations of native and desired non-native species, including threatened, endangered, sensitive, and management indicator species.

- The extent the alternative maintains or restores forest vegetation to a healthy condition with reduced risk of damage from fires, insects, diseases, and invasive species.

- The extent the alternative provides settings for a variety of recreation opportunities, including backcountry or use within a semi-primitive non-motorized recreation setting.

- The extent the alternative provides a variety of uses, values, products and services for present and future generations by managing within the capability of sustainable ecosystems.

Need

The Forest Supervisor and Regional Forester initiated revision of the Forest Plan based on a number of factors, including legal requirements and other needs for change described below.

Legal Requirements

Regulations implementing the National Forest Management Act (NFMA) (1976) require the Regional Forester to revise forest plans and provide the basis for revision. In 1982, instructions to revise forest plans were formulated in the Code of Federal Regulations at 36 CFR 219. The regulations were being revised when our forest plan revision began. The Responsible Official therefore decided to complete plan revision for the Forest under direction provided by the 1982 regulations. Specific instructions found at 36 CFR 219.10(g) state:

> “A forest plan shall ordinarily be revised on a 10-year cycle or at least every 15 years. It also may be revised whenever the Forest Supervisor determines that conditions or demands in the area covered by the plan have changed significantly, or when changes in RPA policies, goals, or objectives would have a significant effect on forest level programs.”

The Forest Supervisor determined that revision was warranted due to the time period allotted for revision, and because significant changes had occurred in conditions and demands. These changes are summarized in the Need For Change section below.

Need For Change

The Monongahela National Forest began evaluating the need for changing the Forest Plan in 2001, anticipating that the Forest Plan would be revised beginning in 2002. A preliminary evaluation began with the assessment of new information and changed conditions that occurred during implementation of the current Forest Plan. Sources of information for this effort include:

- Meetings with Forest Service employees on each Ranger District;
- Discussions with non-governmental partners and interest groups;
- Discussions with other federal and state agencies, and county officials;
- Review of major decisions that were influenced by the current Forest Plan;
- Review of issues raised in appeals and litigation;
- Results of monitoring and evaluation;
- Changes in law and policy that are relevant to planning and management; and
- Relevant new scientific information.

The Forest adopted a five-step process to identify revision topics. The five steps were:

1. Identify preliminary topics through internal scoping and discussion,
2. Gather public input on the preliminary topics through meetings and the NOI scoping,
3. Document, categorize, and consider public input,
4. Refine revision topics as a result of considering public input, and
5. Review the need for change topics against the Analysis of the Management Situation (AMS). Adjust topics or AMS as needed.

Topic identification was used to develop a framework, which served as a basis and focus for public comment, discussion, and evaluation of the 1986 Plan. Via initial scoping, several indicators suggested a need for revising the 1986 Forest Plan. These indicators were:

Land conditions and public demands have changed.

Increasing demand for Forest commodities such as game wildlife and outdoor recreation opportunities suggested needed changes. Recognition of the importance of long-term ecosystem health has also risen, especially with an increase in forest age and associated insect and disease effects. There was a need to revise the Forest Plan to recognize these changes in conditions and demands and to evaluate their effects on ecological sustainability, including social and economic aspects of a sustainable and healthy forest ecosystem.

Laws, policies, and forest planning protocols have changed since 1986.

Some examples of these changes include: the Government Performance and Results Act Strategic Plan (1998, 2004) affecting management priorities, the National Heritage Strategy affecting cultural resource management, the Roadless Area Conservation Rule (2001) affecting roadless areas, Forest Policy Statements on Ecosystem Management (1992) affecting Forest management in general, Scenery Management System (1999) affecting scenery management, and the Strategic Fire Plan (2000) and the Healthy Forests Restoration

Act (2003) affecting vegetation and fire management. These changes have shifted the course of agency goals and programs since 1986, and need to be addressed in Forest Plan revision.

Results of monitoring and evaluation suggest the need for revision.
Annual Forest Plan implementation, monitoring and evaluation results show that it is not always possible to implement plan direction and still achieve the plan's desired future conditions and projected outputs.

New information has become available.
New scientific information has been released since 1986, including the Southern Appalachian Assessment, State/EPA listings of 303(d) water bodies, new or updated conservation assessment or recovery plan information, research findings on riparian buffer effectiveness, improved data and historical estimates of forest types and conditions, updated ROS and IRA mapping for the Forest, to name a few. This type of new information should be incorporated into Forest Plan revision.

Through this initial process, five preliminary issues were identified and published in the NOI in May 2002. These preliminary issues were:

- Watershed Health
- Ecosystem Health
- Vegetation Management
- Visitor Opportunities and Access
- Land Allocations

In May 2002, the Forest conducted public scoping on the Forest Plan revision. A Notice of Intent (NOI) to prepare an EIS to revise the Forest Plan was published, which initiated a 90-day public scoping period. Six open houses were held across the Forest during this time. The purpose of the scoping period was to gather public input on the draft preliminary issues to identify additional, or refine existing, Need for Change topics. A total of 705 responses were received, of which 412 were form letters. A content analysis of the comments was completed in April 2003 to provide an impartial summary of the comments received.

All public suggestions related to Need for Change topics were considered. Criteria were then developed to identify key factors or conditions that must be met to determine Need for Change topics or to refine revision topics listed in the NOI.

The criteria were:

1. Is the suggested change relevant to one of the six decisions made in the Forest Plan?
    - Forest-wide multiple-use goals and objectives
    - Forest-wide management requirements (standards and guidelines)
    - Management prescriptions and direction
    - Lands suited and not suited for timber production, and ASQ
    - Monitoring and evaluation plan
    - Evaluation of roadless areas in order to make wilderness recommendations
2. Is the suggested need for change consistent with national law and policy?

3. Is the suggested need for change within the Forest Service's decision-making authority?
4. Is the suggested need for change a Forest Plan implementation issue or site-specific analysis?
5. Is the suggested need for change already adequately addressed in the current Forest Plan?
6. Can the suggested need for change be adequately addressed through the Forest Plan or is it outside the scope of Forest Planning?

If the answers to questions 1-3 were yes, and the answers to questions 4-6 were no, and the issue engendered high interest or controversy with employees and/or the public, the issue was considered a major need for change topic, to be fully analyzed in the Plan Revision EIS. If the suggested need for change was of narrow scale and scope, or without much public concern, or widely supported, or considered an improvement or clarification, it was labeled a minor need for change that would be addressed typically with changes to management direction.

Some of the suggestions concerning need for change in the Forest Plan will not be addressed during Forest Plan revision. In most cases, the reasons those suggestions are not being addressed is due to the application of the evaluation criteria discussed above. Some of the more common reasons include:

- The suggestion is already adequately addressed in the Forest Plan or recent decision;
- Sufficient information or rationale is not available to support a change in the Plan;
- The suggestion is outside the mission or authority of the Forest Service; or
- The suggestion is an implementation item that is more appropriately addressed at the project level.

Other suggestions—like ATV travel management, WSR suitability studies, and an NRA Plan—were also too time-consuming to take on during revision. Because the Forest has been given limited time and resources to devote to the revision process, the Forest Leadership Team decided that Forest Plan Revision would only address those issues that are most critical and best meet the criteria described above. Other issues would be addressed through ongoing plan maintenance and amendments, or separate planning processes.

Need for Change Topics

The Revision Team reviewed and refined the preliminary NFC topics as a result of the evaluation criteria used with the content analysis. The final major NFC topics were:

- Backcountry Recreation
- Vegetation Management
- Timber Supply
- Soils and Water

These topics were carried forward to become major Need for Change topics or issues for the DEIS and FEIS. The Backcountry Recreation topic is addressed in the Recreation and Wilderness issue described in the Issues Analyzed in Detail section, below. The Timber Supply and Vegetation Management topics are covered under the Timber Supply and Vegetation Management issues, below. The Soil and Water topic is covered primarily under the Soil Resource issue, below, although additional information related to this topic can be found in the Air Quality and Watershed, Riparian, and Aquatic Resources issues.

ISSUES

Issue Identification

Issues are used in environmental analysis to formulate alternatives, prescribe mitigation measures, or analyze environmental effects among alternatives. At the forest planning level, mitigation measures are incorporated into management direction (goals, objectives, standards, and guidelines) or Management Prescriptions that influence the type, amount, and intensity of management actions that may be implemented under the Forest Plan. The Responsible Official selected major issues for revision based on the need for change topics listed above and one or more of the following criteria:

- Would these issues be used to help develop management alternatives or management direction, or would they be used in the allocation of Management Prescriptions?

- Would the management alternatives, direction, or prescriptions have discernable effects on the issues, their related resources, Forest programs, or outputs?

- Would effects to the issues be sufficiently different by alternative to provide the Responsible Official with rationale for choosing a preferred or selected alternative?

Issues are described below using an issue statement, a brief background explanation that includes how the issue was considered in the revision process, and a summary of the issue indicators used to track effects associated with the issue. More detailed information concerning the issues and indicators can be found in the various sections of Chapter 3 in this EIS.

Most issues are described in terms of how Forest Plan management strategies may affect specific resources or conditions. The term "management strategies" generally refers to Forest Plan management direction (i.e., goals, objectives, standards, and guidelines) and the allocation of Management Prescriptions (MPs) that differ by alternative. The MPs provide a broad range of management emphasis that would allow for a different mix of management activities and intensities to potentially occur under each alternative. The Forest Plan, however, does not authorize the implementation of any management activities.

Issues Analyzed in Detail

Issues are described below in the same order they appear in Chapter 3. The order is organized around similar resource groupings. Physical resources (air, soil, water) are described first, followed by biological issues (species, habitats, vegetation), and then social and economic issues (timber, minerals, recreation, wilderness, scenery, roads, economics).

Air Quality

Issue: Forest Plan management strategies may affect air quality in and around the Forest.

Background: Although a majority of this area's pollution comes from sources outside the Forest, activities from within the Forest boundaries can also affect air quality in the region. Activities such as timber harvesting, oil and gas well drilling and operations, road construction/ maintenance and prescribed fires all produce emissions. Additionally, effects of these activities may exacerbate existing air quality related issues. However, not all of these activities are expected to change significantly for all alternatives within this planning period. Natural gas exploration and development is expected to remain at current levels, or decrease from existing levels, depending on the alternative. Also, the number of days where road construction or maintenance occurs is not expected to increase over existing levels, and is not a major component of air pollution problems in West Virginia. The remaining two activities, timber harvesting and prescribed fire, are expected to change within the planning period. Particulate matter (PM) and Nitrogen Oxide (NOx) emissions from these activities will contribute to the total pollution load and are the major pollutants of concern in terms of contributions to NAAQS. Therefore, potential emissions of these pollutants will serve as indicators for air quality effects.

Indicators: Potential emissions of PM and NOx from predicted timber harvest and prescribed fire are evaluated and compared to total PM and NOx emissions in counties near the Forest.

Soil Resource

Issue: Forest Plan management strategies may affect the soil resource.

Background: Erosion and acid deposition occur to varying degrees across the entire Forest, and their effects to soil can be exacerbated by soil disturbance. The Management Prescriptions (MPs) in the Forest Plan provide for a variety of activities to occur on varying soil types, ranging from little or no management (i.e., soil disturbance) in Wilderness areas to activities that call for a total commitment of the soil resource where soil is removed and replaced with a permanent facility. Although certain soil-disturbing activities, like mineral development or mountain biking, can occur in localized areas throughout the Forest, large-scale soil disturbance associated with timber harvest and road construction most often occur in MPs with suitable timberland. Because the amount and distribution of these MPs and their predicted activities vary by alternative, they can be used to show relative differences in the potential that timber harvest and road construction may have for impacts on soil quality and productivity related to:

1) Soil erosion and sedimentation, and
2) Soil nutrient depletion and soil acidification related to acid deposition

Indicators: The following indicators are used to reflect the potential relative change under each alternative based on anticipated levels of management activities that could have substantial effects on the soil resource:

- Acres of potential timber harvest in suited MPs by alternative,
- Acres of high-risk acid sensitive soils by MP by alternative.

Watershed, Riparian, and Aquatic Resources

Issue: Forest timber management strategies may affect watershed, riparian and aquatic resources.

Background: Timber harvest and connected actions have the potential to affect a number of watershed processes. The removal of timber, the type of logging method used and the associated transportation system all have the potential to affect watershed, riparian and aquatic conditions to varying degrees. The potential risk of these activities is dependent on the scope of the action, the existing site conditions, and the effectiveness of the mitigation measures used. Because the amount and distribution of timber harvest varies by alternative, it can be used to show the relative differences in the potential impacts related to:

- Soil erosion and sedimentation effects on aquatic ecosystems,
- Soil nutrient and base cation depletion and soil acidification related to acid deposition,
- Water quality and quantity, and
- Channel and floodplain modifications.

Indicators: The following indicators are used to reflect the differences between alternatives and the potential risk to watershed, riparian and aquatic resources:

- Acres of Management Prescriptions that allow commercial timber harvest by alternative,
- Acres, volume, and logging methods of potential timber harvest by alternative.

<u>Terrestrial Ecosystem Diversity (Coarse Filter)</u>

Issue: Forest Plan management strategies may affect the amount, distribution, structure, and composition of ecological communities.

Background: Ecological communities are the foundation of biological diversity. Communities on the Forest include those in need of ecological restoration, such as spruce forests and oak forests, as well as unique communities in need of protection, such as bogs and shale barrens. A key function of forest planning is to provide for such restoration and protection needs while also providing a mix of diverse habitats to meet the demands of multiple uses.

To address the requirements for maintaining diversity and viable populations, the Forest Service has developed an analysis process called species viability evaluation. Species viability evaluation takes a two-part approach that is referred to as a “coarse-filter/fine-filter” approach, or an “ecosystem diversity/species diversity” approach. Coarse-filter analysis refers to evaluating biodiversity conservation through a classification and assessment of the component ecosystems that make up a landscape. It is based upon the theory that conserving an adequate representation of plant and animal communities will maintain most species that occur in a given planning area.

This analysis focuses on ecological communities that predominate on the landscape; communities that are rare, unique, or declining; and communities that provide habitat for species with potential viability concerns. Communities were evaluated for direct effects of management on National Forest System (NFS) land. Communities and the species that inhabit them also are affected by activities on intermingled non-NFS land; therefore, the cumulative effects of Forest Service and other activities were evaluated to the extent possible for all land within the Forest boundary (proclamation boundary and purchase units).

Indicators: The indicators for this issue are:

- Amount and development stages of major forested communities by alternative,
- Amount of each rare and unique community potentially affected by alternative,
- Representation of ecological communities in Minimum Dynamic Area reserves (potential old growth) by alternative.

Terrestrial Species Viability (Fine Filter)

Issue: Forest Plan management strategies may affect the level of risk to species with potential viability concerns, and may also be used to provide a mix of habitats for the species found on the Forest.

Background: Maintenance of species viability is an integral component of the Forest Service's responsibility to conserve biological diversity. The fine-filter analysis focuses on species that may have viability concerns within the Forest boundary or have been identified by others as species of concern due to declining populations or other factors. From the 451 potentially rare or declining species that were considered in this analysis, the screening process produced a list of 213 species to be evaluated in detail (see Appendix D). These species include 14 mammals, 60 birds, 5 amphibians, 5 reptiles, 52 invertebrates, 70 vascular plants, and 7 nonvascular plants.

Because of the large number of species evaluated and a lack of detailed information for many of them, quantitative population viability analysis was not a practical way to assess species viability. Instead, a qualitative rating system was used that produced a viability outcome for each species. These outcomes range from A to E on a graduated scale, depending on habitat abundance, habitat distribution and connectivity, and population factors.

As part of its strategy to address NFMA viability requirements and avert the need for listing under the Endangered Species Act (ESA), each region of the Forest Service has developed a list of Regional Forester's Sensitive Species (RFSS), which are species for which population viability may be a concern. Direction in the Region 9 supplement to the Forest Service Manual emphasizes maintaining viability for RFSS and ensuring that management activities do not result in trends toward federal listing (FSM 2670.22, 2670.32). Manual direction requires Forests to determine whether their actions will affect RFSS, and if so, whether the actions will result in a loss of viability or a trend toward federal listing (FSM 2670.32).

Indicators: The indicators for this issue are:

- Distribution of viability outcomes by alternative,
- Effect determinations for Regional Forester's Sensitive Species by alternative.

Terrestrial Management Indicator Species (MIS) and Other Species of Interest

Issue: Forest Plan management strategies may affect habitat for MIS and other species of management interest.

Background: NFMA regulations require Forests to select MIS to estimate the effects of each alternative on fish and wildlife populations. The regulations further direct that MIS are to be chosen that are believed to indicate the effects of management activities. Planning alternatives must be evaluated in terms of habitat and population trends of MIS (36 CFR 219.19(a)(2)), and MIS are to be monitored during plan implementation and relationships to changes in habitat determined (36 CFR 219.19(a)(6).

Proposed MIS for the Forest are cerulean warbler, wild turkey, West Virginia northern flying squirrel, and eastern brook trout. The Forest revised its MIS list for several reasons. Experience has shown that some of the MIS chosen for the 1986 Forest Plan are habitat generalists whose populations cannot easily be related to management-related changes in habitat (e.g., white-tailed deer, black bear). Other species have proven difficult to monitor because of low populations, sparse distributions, or cryptic habits (e.g., snowshoe hare). Also, the Forest's 10-species MIS list under the 1986 Plan has challenged our ability to collect meaningful monitoring data. In revising the MIS list, we have emphasized species that are closely associated with habitats of interest. Habitat indicators were projected for Forest Service land to reflect direct and indirect effects of expected Forest Service management. Habitat indicators for the terrestrial MIS and other species of interest are described below; indicators for brook trout are discussed in the *Watershed, Aquatic, and Riparian Resources* section. A limited habitat-related discussion is included here for West Virginia northern flying squirrel, and a more detailed analysis for this species is included in the *Threatened and Endangered Species* section.

Many species on the Forest—other than viability concern species, threatened and endangered species, sensitive species, and MIS—are important to the public. While analyzing every species on the Forest is not practical, the Forest is home to two high-interest game species that are not included in the other wildlife categories analyzed in this EIS: white-tailed deer and black bear.

The white-tailed deer is the most popular game animal in West Virginia. However, in addition to its value as a game animal, the white-tailed deer is a voracious browser, and high deer densities can affect the composition and structure of forest communities. At high population densities, deer becomes a keystone species with the capacity to hinder forest regeneration, change the composition and structure of the understory, and affect other wildlife species through direct competition and changes in habitat.

The black bear is a popular game animal in the region, and is also popular with wildlife watchers. Compared to most other wildlife, black bears have large home ranges and require habitats with low densities of open roads to serve as refuges from disturbance and hunting mortality. Because of this special requirement for large blocks of relatively remote habitat, the Forest provides much of the prime bear habitat in the region.

Indicators: Effects to the following habitats for MIS and other species of interest are analyzed and compared by alternative:

- Optimum habitat for cerulean warbler – area of mid-late and late successional (80+ years old) mixed mesophytic and cove forests.

- Optimum habitat for wild turkey – area of oak and pine-oak forest of optimum mast-producing age (50-150 years old), plus openings, within MPs 2.0, 3.0, 6.1, and 6.3.

- Optimum habitat for West Virginia northern flying squirrel (area of mid-late and late successional spruce forest) and potential active spruce restoration areas (roughly approximated by area of mid-late and late successional northern hardwoods in MP 4.1, outside of current suitable flying squirrel habitat).

- Edge habitats providing abundant browse for white-tailed deer – all early successional forest (0-19 years old) plus openings.

- Optimum habitat for black bear – 50 to 150-year-old oak and pine-oak forest in MPs with limited public motorized access (MPs 4.1, 5.0, 5.1, 6.1, 6.2, 6.3, and remote backcountry portions of the NRA).

Threatened and Endangered Species

Issue: Forest Plan management strategies may affect federally listed species and their habitats.

Background: Federal agencies must comply with the ESA of 1973 as amended, which includes a requirement to consult with the U.S. Department of Interior, Fish and Wildlife Service (USFWS) on projects that may affect federally listed threatened, endangered or proposed species. Currently there are 9 federally listed species known to occur on the MNF, but no species that are proposed for listing.

Although Forest Plan revision would have no direct effects on T&E species, Plan revision does provide for species protection and habitat restoration through management direction and the allocation of management prescriptions that would limit or prohibit management activities that pose a threat to T&E species or their habitats. Other management prescriptions could allow certain activities that may pose threats. This analysis will look at the relationships between those prescriptions and how management allowed within them may potentially affect listed species and their habitats.

Indicators: For each listed species, effects are assessed by determining whether Forest Plan management direction is adequate to protect listed species and their habitats from potential direct, indirect, and cumulative effects of the four management alternatives considered in detail. Potential effects for some species are based on the level and intensity of management activities that could occur under the Management Prescriptions assigned to each alternative. Specifically, the following habitat components are used to assess effects on these species:

Running buffalo clover: Potential effects to young and old successional stages of mixed mesophytic forest by alternative.

Shale barren rock cress: Potential effects to shale barrens by alternative.

Small whorled pogonia: Potential effects to old and mature mixed mesophytic forest, old and mature oak forests, and old and mature pine-oak forests by alternative.

Virginia spiraea: Potential effects to the banks of low-elevation large streams by alternative.

Virginia big-eared bat: Potential effects to foraging area, maternity sites, and hibernacula by alternative.

Indiana bat: Potential effects to maternity site habitat, hibernacula, key areas, and primary range by alternative.

West Virginia northern flying squirrel: Potential effects to suitable habitat (high-elevation spruce and spruce-hardwood forests) by alternative.

Cheat Mountain salamander: Potential effects to Cheat Mountain salamander habitat by alternative.

Bald eagle: Potential effects to nesting habitat in riparian areas by alternative.

Additionally, species viability outcomes from the Species Viability Evaluation are used as an indicator of potential cumulative effects on all the species noted above.

Non-native Invasive Plant Species

Issue: Forest Plan management strategies may affect the spread and control of NNIS.

Background: NNIS have been recognized at the national level as one of the four major threats to the ecological sustainability of National Forest Systems (NFS) land. NNIS spread via a variety of pathways. For most species, invasion and spread are facilitated by some type of human-caused habitat alteration, especially those alterations that include soil disturbance. Typical alterations that can encourage NNIS include roads, hiking and horse trails, grazing allotments, utility corridors, wildlife openings, or vegetation management. Some of these factors, such as trails, grazing allotments, and utility corridors, are not likely to change much by alternative. However, road construction and wildlife opening construction are likely to vary according to the amount of land that is allocated to MPs that emphasize vegetation management. Road construction is directly related to the amount of timber harvesting that is conducted in areas that do not already have adequate access.

Indicators: The indicators for this issue are:
- Amount of timber harvest 3/8 of a mile or more from existing roads by alternative,
- Amount of maintained openings by alternative.

Vegetation Management

Issue #1: Forest Plan management strategies may affect the potential for vegetation diversity and sustainability across the Forest.

Background to Issue #1: The Forest Service is responsible for providing a diversity of plant and animal communities and tree species while providing for the overall multiple-use objectives of national forests (36 CFR 219.26). The Forest Service is also responsible for ensuring a sustainable flow of forest products (Multiple-Use Sustained Yield Act).

An estimated 70 to 80 percent of the Forest is currently the same approximate age (70-100 years) with similar stand conditions. Conversely, there are relatively few forest stands in younger age conditions. The effects of an aging forest include: 1) an increasing susceptibility to forest decline and mortality from insect and disease outbreaks; 2) a decrease in timber and mast productivity and wildlife habitat diversity; 3) an increase in shade-tolerant tree species; and 4) an increase in fuel loads from both down and standing dead trees that result in a higher potential of more severe fires during periods of extended or extreme drought.

A mix of age classes across the Forest is more conducive to long-term sustainability and diversity to provide a variety of habitats and products in perpetuity. Forest management can affect the mix of age classes or successional stages by implementing regeneration harvests in those Management Prescriptions that allow or emphasize vegetation management. The amount and distribution of these Management Prescriptions vary by alternative, and therefore can be used as an indicator for potential even-aged regeneration harvests and successional stage changes by alternative.

Creating variety in the age class structure in forested stands across the landscape through use of even-aged regeneration harvesting, as opposed to greater variety in age class structure within a stand as a result of uneven-aged stand management, creates diversity that helps lessen the effects of aging and decaying forests. Increases in tree mortality, insects, disease, and shade-tolerant tree species are all part of the aging of a forest and are not inherently negative. However, the concern is that a very large percentage of the Forest will be going through these changes at the same time. Providing for diversity in age classes is one way to reduce the impacts of these changes across the landscape so that mast and timber production, regeneration of shade-intolerant species, and habitat variety are better sustained at the landscape level.

Indicator for Issue #1: Age class distribution by alternative.

Issue #2: Forest Plan management strategies may affect the potential for vegetation restoration in oak and spruce communities on the Forest.

Background to Issue #2: Species composition is best illustrated using forest types. A forest type indicates the dominant tree species or group of species present but does not always reflect all of the species present in a forested stand. Usually numerous other tree species are also present with the tree species that define a forest type, but in fewer numbers. On the MNF, plant species common to northern climates intermingle with plant species common to southern climates. This results in stands with a great number of species and species mixes. Over 40 commercial tree species occur on the Forest, and it is not uncommon to find 10 to 15 commercial species growing in a 10-acre stand. This high level of diversity is due to the unique geographic, climatic, and topographic features of this area.

Oak communities are currently in decline due to changes in stand density, structure, and composition leading to a decreasing trend in vegetation diversity. In areas where fires helped perpetuate oak and oak-hickory forests, decades of fire suppression have created conditions where oak species are not competing well with species such as striped and red maple and American beech. Light conditions in the mid-story are not suitable for oaks to regenerate. Timber harvest and prescribed fire can be used to mimic the effects of historic fire regimes in areas where these activities are both allowed by Forest Plan direction and are considered ecologically appropriate.

Although red spruce has been slowly expanding its range over the past few decades, red spruce and spruce-hardwoods mixed forests once covered much more area than they do today. While opportunities for active restoration of the red spruce community are limited in areas of suitable habitat for the West Virginia northern flying squirrel, there are areas where red spruce and mixed red spruce-hardwood forests could be actively managed to increase red spruce dominance.

The oak and red spruce communities represent the ends of the spectrum of diversity on the Forest. Red spruce dominates at higher elevations, under cool moist conditions, while oak communities flourish under drier, warmer conditions at lower elevations. Fire was historically a frequent visitor to oak communities, usually about every 7 to 32 years in a given area; however the fires were typically low intensity, mainly affecting the ground surface. In red spruce communities fire is not the driving disturbance regime, as it may have replaced stands only every 300 to 1,000 years. However, when fire occurred in spruce stands it was most likely of high intensity, resulting in stand replacement.

This analysis focuses on the potential effects from management prescribed under each of the alternatives, and how that management may affect the diversity, sustainability, and general health of oak and spruce communities within the Forest.

Indicators for Issue #2: The indicators for Issue #2 are:
- Acres of potential change in restoration of oak and spruce communities by alternative,
- Acres of Fire Regime I Condition Class 3 and Fire Regime III Condition Class 2 in MPs 3.0, 6.1, and 8.1 by Alternative.

Timber Supply

Issue: Forest Plan management strategies may affect the amount of land suitable for the sustainable harvest of timber products, the amount of timber offered by the Forest, and the methods used to harvest the timber.

Background: In 1897, the Organic Act established the national forests to furnish a continuous supply of timber to the nation and to protect watersheds. This direction remains today. The regulations for the National Forest Management Act (NFMA) require the Regional Forester to estimate the maximum amount of timber that can be sold annually on a sustained-yield basis. The NFMA also requires the identification of lands that are not suited for timber production.

The 1986 Plan identifies 46 percent of Forest lands as suitable for timber production. Some of this area may be unsuited for timber production because of constraints such as extremely steep slopes or limited access. Changes in national policy, such as the Roadless Area Conservation

Rule, have identified additional areas that may now be inappropriate for commercial timber production. On the other hand, trees have been growing for 18 years since 1986, and this growth has added considerably to the potential timber volume on the Forest. There is an identified need to recalculate timber production potential for the Forest.

Timber management on the Forest is primarily influenced by the allocation of Management Prescriptions (MPs), as some areas on the Forest are assigned prescriptions that allow or emphasize timber harvest, and others are not. Some of the MPs are considered not suitable for managing timber, and some include lands that are both suitable and unsuitable. The prescriptions with suitable lands also have desired conditions for vegetation that may affect the harvest methods used to achieve them. The range of alternatives proposed in this EIS have different allocations of MPs, and can be used to show relative differences in timber production and methods based on those allocations.

Indicators: The following indicators reflect the potential relative change under each alternative based on anticipated levels of management activities that could have effects on timber supply.

- Acres of land suited and not suited for timber management by alternative,
- Potential cubic board feet of ASQ by alternative,
- Acres treated by harvest method by alternative.

Mineral Resources

Issue: Forest Plan management strategies may affect mineral resources available for exploration and development.

Background: Forest Plan direction for the management of mineral resources has been revised during the revision process. Forest-wide desired conditions and goals were added, and a number of the standards and guidelines that were in the 1986 Forest Plan, as amended, were rewritten for clarity and integrated with other Plan resource direction. Some standards and guidelines were eliminated because they were repetitive, or they were better suited to an implementation guide, or they were already covered by law, regulation, or policy. Management Prescription direction was reviewed and updated in a similar manner. The overall result of these direction changes is that revised protection for and from mineral resource activities is much the same as in the 1986 Forest Plan, and desired conditions and goals for mineral management have improved.

The major effects to mineral management that this analysis will assess are related to Forest Plan Management Prescriptions (MPs). The MPs contain management direction for mineral management that could potentially affect mineral exploration and development. In particular, there is a standard that prohibits surface occupancy on federal gas and oil leases in several MPs that would restrict lease operators from exploring and developing gas reserves in all but the outer portions of the prescription unit areas. Because the MP allocation changes by alternative, the potential effects from the MP prohibition of surface occupancy would change as well. This analysis identifies how much gas production may be affected by alternative due to these changes.

Indicators: The following indicators reflect the potential relative change by alternative based on management direction that could affect the availability of mineral resources:

- Percent of federally owned natural gas acres available for exploration and development,
- Billions of cubic feet of potential natural gas resources available for production from the MNF.

Recreation and Wilderness

Issue: Forest Plan management strategies may affect the amount of backcountry recreation areas offered by the Forest, including areas recommended for wilderness.

Background: The 1986 Forest Plan emphasizes backcountry recreation on approximately 124,500 acres of primarily semi-primitive non-motorized (SPNM) landscapes, as described for MP 6.2. Over 78,000 acres of congressionally designated Wilderness (MP 5.0) also support this type of management emphasis. The combined MP 6.2 and 5.0 areas that emphasize backcountry recreation make up an estimated 22 percent of the Forest.

As one of the six decisions made in Forest Plan revision, the Forest re-inventoried its roadless areas in order to evaluate those areas for wilderness potential. The Roadless Area Inventory process looked at all existing MP 6.2 areas, Roadless Area Review and Evaluation (RARE II) areas, areas inventoried for the Roadless Area Conservation Rule and any area 5,000 acres or greater with less than ½ mile of improved road per 1,000 acres to determine if they qualified as Inventoried Roadless Areas (IRAs). The inventoried areas provide the best opportunities for 6.2 management, as well as the best pool for potential Wilderness recommendations. As there are no recommended Wilderness areas in the 1986 Forest Plan, a new MP (5.1) was created for Forest Plan revision to represent Wilderness Study Areas.

This issue explores the question of whether the current mix of management emphasis associated with backcountry recreation is an appropriate amount and distribution across the Forest. It also looks at how much if any area should be recommended for wilderness study.

Indicators: The indicators used to measure effects on this issue are:
- Acres of MP 6.2 (Backcountry Recreation) by alternative,
- Acres of MP 8.1 SPNM (backcountry recreation within the NRA) by alternative,
- Acres of MP 5.1 (Recommended Wilderness) by alternative,
- Total Acres of Backcountry Recreation opportunity (5.0, 5.1, 6.2, 8.1 SPNM) by alternative,
- Recreation Opportunity Spectrum (ROS) Class distribution by alternative,
- Percent contribution to backcountry recreation opportunities in West Virginia by alternative.

Scenic Environment

Issue: Forest Plan management strategies may affect the scenic environment.

Background: No major issues directly related to scenic resources were identified during public involvement or the Need For Change analysis process. However, many comments received did indicate an interest in the Forest's scenery and how management activities may affect that scenery. Management activities have the potential for directly, indirectly, and cumulatively affecting scenic resources through vegetation management, restoration, or development activities. These activities are related to many of the Need For Change topics, and could be implemented under any of the alternatives. Disturbance events of insect infestations and wildfire events can also affect scenic resources.

Indicators: The following indicators reflect the potential relative change under each alternative based on anticipated levels of management activities that could have substantial effects on the scenic environment:

- Acres of even-aged harvest by alternative,
- Acres of intermediate harvest treatments by alternative,
- Acres of prescribed fire use by alternative.

The potential for ecological disturbance events (insects, disease, wildfire) to affect the scenic environment is also discussed.

Road Transportation System

Issue: Forest Plan management strategies may affect the road transportation system and the public access that the roads provide.

Background: Management of National Forest System roads is an issue of national concern. Public interest in the roads within National Forests is increasing, and few natural resource issues in recent years have attracted as much public scrutiny as road management. Concerns linked to the roads within National Forests include public access, resource damage, habitat loss, maintenance capabilities, and economics. Yet some level of road development is needed to produce the goods and services that Americans expect from their National Forests.

Comments received both externally and internally reflected two components: the number of amount of Forest roads that are developed, and the access they provide to the public. A number of comments focused on the amount of roads that should be maintained as part of the system. Comments were divided between those expressing the need to maintain current access and roads for resource management and recreation needs and those supporting a smaller road system to reduce impacts of roads on other resources. Some comments expressed concerned that overall access to the Forest was decreasing. Other comments expressed concern about concentrating public use on fewer and fewer acres, thus causing increased resource damage. Still other comments questioned the merits of reducing the road system in the face of expanding recreation use and access needs. Opposing comments favored a policy of “no new roads”, especially in areas that are currently classified as unroaded.

Indicators: The following indicators are used to measure the effects of management strategies on Forest roads on the Forest by alternative:

- Potential change in forest classified roads related to timber harvest by alternative,
- Potential change in public motorized access related to Management Prescription allocation by alternative.

Social and Economic Environment

Issue #1: Forest Plan management strategies may have social and economic effects on local counties and communities.

Background to Issue #1: The socio-economic environment is not directly linked to any of the Need For Change topics found in the AMS Summary (USDA Forest Service 1997) for the Forest Plan revision. However, nearly all Forest management activities have the potential to directly or indirectly affect the socio-economic environment (chiefly counties and communities). These activities are related to, or could be implemented under, all alternatives.

Indicators for Issue #1: Indicators for this issue include county populations, lifestyles, attitudes, beliefs and values; social organization, land-use patterns, civil rights, employment and income, and federal payments to counties.

Issue #2: Forest Plan management strategies may affect the financial efficiency of operating the National Forest.

Background to Issue #2: The financial and economic efficiency of operating the National Forest is of great concern to the Forest Service and public alike. Controversy has swirled in recent years around such financial issues as “below-cost” timber sales, “subsidized” grazing, and recreation facilities that are deteriorating due to lack of maintenance or replacement funding.

Indicators for Issue #2: The indicator used in financial and economic efficiency analysis is Net Present Value (NPV), in which discounted costs are subtracted from discounted values over a 50-year time period.

Issues Not Analyzed in Detail

In addition to the issues described above, there were many minor Need For Change topics that were considered as issues but not necessarily analyzed in detail in this EIS. Those topics or issues, and how they were addressed in Plan revision, are described below.

Range Resources

Range allotments on the Forest cover less than one percent of the federal land base, and they are not expected to increase or decrease substantially over time, or change by alternative in the EIS. Forest-wide and Management Prescription direction for Range Resources was reviewed and updated in the 2006 Forest Plan. Effects from livestock grazing are discussed under General Effects in the Chapter 3 resource sections.

Scenery Management System

The Scenery Management System (SMS) is the new agency-mandated method for management of scenic values, replacing the previous Visual Quality Objective System. Use of this new system has been incorporated into the 2006 Forest Plan. Effects to the Scenic Environment are analyzed in detail in Chapter 3 of this EIS.

Monitoring and Evaluation

Through implementation of the monitoring and evaluation plan, the Forest has found that some Forest Plan requirements cannot be fully implemented, do not yield meaningful results, are not measurable or scientifically supported, or are not reasonably affordable. The Monitoring and Evaluation Plan was revised and improved to ensure cost-effective, meaningful surveys are completed, and to meet the latest agency requirements. This is one of the six planning decisions to be made in Forest Plan revision.

Heritage Resources

A review of the 1986 Forest Plan indicated that updates were needed in the direction for heritage resources. The 2006 Forest Plan includes new direction to address changes in the Heritage Program since 1986, and to ensure NRHP-eligible sites are adequately protected. Heritage resources were not analyzed in detail in this EIS, as they were not identified as an issue or concern, and potential effects to or from the resources would not vary measurably by alternative.

Land Acquisition

Current land acquisition priorities do not necessarily reflect direction provided in the 1986 Forest Plan. This direction was reviewed and updated in the 2006 Forest Plan. In addition, lands located outside of the Forest proclamation boundary have been purchased since 1986. These lands have been assigned a management prescription in Forest Plan revision.

Fire Management/Prescribed Fire

The 1986 Forest Plan emphasizes fire protection and prevention. The 2006 Plan broadens the focus to using fire as a management tool for ecological restoration and fuel reduction. This strategy includes all activities required for protecting natural resources and property from fire, and the use of fire to meet resource and land management goals. Effects from prescribed fire and fire suppression are addressed in many resource sections in Chapter 3 of this EIS.

Planning Areas

The 1986 Forest Plan divided the Forest into planning areas called Opportunity Areas. The Opportunity Area boundaries do not necessarily follow geographic boundaries, and they focus management activities on relatively small units of land. Ecosystem Management principles introduced by the Forest Service in 1992 emphasize the importance of using watersheds as both a planning and analysis tool. The Forest has embraced this philosophy, and has been conducting watershed assessments for a number of years, but this practice has not been assimilated into the 1986 Plan. The 2006 Forest Plan incorporates the concept of using watershed boundaries as planning areas through changes in management direction. Opportunity Areas have been dropped.

Editorial Changes

Many editorial changes were made in the revision of the Forest Plan. These changes included modifying or clarifying direction in the existing plan, making the plan easier to read and understand, removing items that do not pertain to the six decision made in forest planning, or removing direction that can be found elsewhere, such as in Forest Service manual or handbook direction. These changes were designed to make the 2006 Plan more strategic and less tactical in nature, with more focus on what needs to be done and less on how it should be done.

Species Viability Evaluations

As a part of the requirements in 36 CFR 219, the Forest must ensure that viable populations of species are provided for under the Forest's multiple use management. A species viability evaluation was completed and management options for species or community conservation were developed and incorporated into the 2006 Forest Plan. In addition, language related to specific groups of species was reviewed and updated. These groups include listed species, Regional Forester's Sensitive Species (RFSS), Management Indicator Species, and migratory birds. The RFSS List can and will be updated outside of the revision process. A summary and tables of the Species Viability Evaluation are provided in Chapter 3 of this EIS and Appendix D, respectively.

Wild and Scenic Rivers

Existing eligibility determinations and classifications relating to Wild and Scenic Rivers were brought forward and incorporated into the 2006 Plan. Direction and information concerning these rivers were also added to the Plan. These rivers would not change by alternative in this EIS, and they were therefore not analyzed in detail, although they were considered in some of the effects analyses where appropriate. A check of land ownership changes since the 1995 Draft Wild and Scenic River Study Report indicated that there are no additional river segments to be added to the existing inventory. A suitability recommendation for Wild and Scenic River designation will not be brought forward at this time due to time constraints; however, the trigger for initiating a suitability study was added to Forest-wide direction.

Spruce Knob – Seneca Rocks National Recreation Area (NRA)

Forest Planning direction provides guidance to assign one management prescription to a congressionally designated area. The NRA is assigned several management prescriptions in the 1986 Plan. A Management Prescription was developed and assigned to the NRA for Plan revision, which means that the 1986 prescriptions within the NRA no longer apply. The management complexity of the area is largely addressed through an ROS-related strategy. For example, NRA 6.2 prescription areas in the 1986 Plan would now be managed as a Semi-Primitive Non-Motorized ROS Class, which provides similar management emphasis.

Management Prescriptions

Some of the Management Prescriptions in the 1986 Plan are outmoded or have never really been used to manage resources (1.1, 2.0, 4.0, and 9.0). These have been replaced by new prescriptions that are designed to emphasize specific management strategies in defined areas such as Recommended Wilderness (5.1), Spruce Communities (4.1), and the Spruce Knob – Seneca Rocks NRA (8.1). Other existing prescriptions were reviewed and updated as part of the Plan revision process. This is one of the six planning decisions to be made in Forest Plan revision. These prescriptions are used for analysis in Chapter 3 of this EIS.

Stream Liming

Adding limestone fines to acidic streams decreases their acidity, allowing aquatic resources to live in streams that would otherwise not support a wide variety of aquatic life. This practice is used by the West Virginia Division of Natural Resources on many streams located on the Forest. The Forest Plan allows for this practice, although there are restrictions on mechanical delivery systems in certain parts of the Forest like Wilderness. Stream liming is considered and evaluated on a site-specific basis at the Division's request.

Forest Habitat Fragmentation

Fragmentation may be caused from implementing Forest management activities. Considering the Forest is in a predominantly closed-canopy condition, there is no current internal concern over fragmentation on a landscape level. Potential fragmentation as a result of management activities is addressed in the EIS as part of the *Terrestrial Ecosystem Diversity* analysis. The Forest reviewed the information in the 1986 Plan and updated language for identification and conservation of old growth or mature habitat in Appendix B to the 2006 Forest Plan.

Pesticide and Herbicide Use

Management direction for the use of pesticides, which includes herbicides, was reviewed and updated for the 2006 Plan (see Vegetation section in Chapter II). Before any pesticide-related project takes place on the Forest, the NEPA process would be used to notify the public and solicit comments, analyze potential effects, determine appropriate mitigation measures, and identify a preferred alternative.

ATV/OHV Use/Recreational Trails

The 1986 Plan allows for ATV use on designated routes. This direction has not changed in the revised Plan. The Forest reviewed and updated recreational trail direction as part of the Plan revision process. Although the Forest currently has no designated routes for ATV use, we do have funding in place to begin comprehensive trail management planning in the near future, independent of the revision process. This trail management planning is designed to look at conflicts and opportunities for trail users, and the need to designate more special purpose trails on the Forest.

Inventoried Roadless Areas

The Forest reviewed and updated its roadless area inventory as part of the Plan revision process. These roadless areas were evaluated for wilderness potential in Appendix C to this EIS. These areas were also used to formulate a range of wilderness recommendations for the alternatives in Chapter 2 of this EIS. Evaluating roadless areas for Wilderness recommendation is one of the six decisions in Forest Planning. These roadless areas also offer remote backcountry opportunities, which is a major need for change topic that is analyzed in Chapter 3 of this EIS.

Biological Diversity

Biodiversity encompasses life, processes, and their interconnections. Elements of biodiversity are addressed throughout both the 2006 Forest Plan and EIS, and they include such topics as successional stages, invasive species, water, soil, air, disturbance regimes, and forest age class distribution. See also the *Terrestrial Ecological Diversity* analysis in Chapter 3 of this EIS.

Ecosystem Management Approach

The 1986 Plan was reviewed and updated to present a more ecological approach to management. The Forest is considering this an update, not a major NFC topic or issue. Many elements of Ecosystem Management are addressed by the major issues analyzed in Chapter 3 of this EIS.

1986 Forest Plan Amendments

Much of the 1986 Plan has been incorporated into the 2006 Plan, including key components of the six amendments. Direction from the 1986 Plan as amended was considered as Resource Protection Methods for Alternative 1 in the resource assessments in Chapter 3 of the EIS, and the amendments were reviewed and updated as needed.

Forest Health

Defined broadly, forest health encompasses all aspects of forest conditions. Elements of forest health include vegetation age, composition, spatial arrangement, habitat, fire, insects, disease, non-native invasive species, forest growth, forest productivity and sustainability. Many of these aspects of forest health are addressed in the Vegetation Management section in Chapter 3 of this EIS.

Clearcutting

Clearcutting is the removal of all overstory trees within a timber harvest unit, which rarely if ever occurs on the Forest anymore. Reserve trees are left within harvest units to provide for wildlife habitat, shade, or other resource benefits—the amount of trees left depends on the silvicultural objectives for the area. However, the Forest does use even-aged management prescriptions that may remove most of the overstory trees within a unit. These prescriptions are valid tools for regulating age class and species composition, and are used to help display differences in expected outcomes and effects for the EIS alternatives in Chapter 3 of this EIS.

Research Natural Areas (RNAs)

There are no established RNAs on the Forest, but there are candidate RNAs. These areas are classified as Special Areas under an 8.5 Management Prescription. Effects to or from 8.5 Special Areas are evaluated in a number of resource sections in Chapter 3 of this EIS.

A number of candidate RNAs in the 1986 Plan were dropped in the 2006 Plan because: 1) they were designed to preserve relatively small features on the landscape (a bog, a rare plant community, a hawthorn patch) rather than representative forest types or ecosystems, and/or 2) these features were already protected in other prescription allocations such as Botanical Areas and National Natural Landmarks. Areas that preserve specified forest community types (red spruce, yellow poplar, black cherry) were retained in plan revision. In addition, a new candidate RNA (Pike Knob) was identified through public comments. At 1,950 acres, Pike Knob contains oak and red pine forest community types and several rare plant species or communities.

Chapter 2

Alternatives Considered

Table of Contents

Page No.

Changes to Chapter 2 Between the Draft and Final EIS

Alternatives Considered but Eliminated from Detailed Study – In response to comments on the DEIS, several new alternatives were considered but eliminated from detailed study for the rationale provided for each.

Alternatives Considered in Detail – Alternative 2 Modified was generated from changes suggested by comments on the DEIS. This is a new alternative in the FEIS, with its own description found on pages 2-20 to 2-22.

Comparison of Alternatives – This entire section was updated to include the results of the analyses of Alternative 2 Modified in Chapter 3.

The Preferred Alternative – In response to comments on the DEIS, we expanded this section to provide information on how and why the Preferred Alternative was chosen.

INTRODUCTION

Chapter 2 describes the management alternatives considered for Forest Plan revision. This chapter also summarizes and compares the effects of those alternatives on the major issues presented in Chapter 1. Chapter 2 is divided into the following sections:

- **Development of the Reasonable Range of Alternatives –** discusses how the alternatives were developed, and what constitutes a reasonable range of alternatives, including alternatives that were considered but not studied in detail for a variety of reasons.

- **Alternatives Considered in Detail –** describes the alternatives that the Revision Team analyzed in depth.

- **Comparison of Alternatives –** summarizes and compares the environmental effects of the alternatives.

- **The Preferred Alternative –** identifies the preferred alternative in the Final EIS.

Maps showing the alternatives considered in detail are included in the map packet accompanying this document. Each map shows the Management Prescriptions for that alternative.

DEVELOPMENT OF THE REASONABLE RANGE OF ALTERNATIVES

As described in Chapter 1, public comments received in response to the Notice of Intent resulted in major Need for Change topics to the Proposed Action (Alternative 2). Those topics or issues were used to generate a preliminary set of management alternatives. These preliminary alternatives were then broken into "Alternatives Considered but Eliminated from Detailed Study" and "Alternatives Considered in Detail"; both sets of alternatives are included in the reasonable range of alternatives considered for plan revisions.

All reasonable alternatives to the Proposed Action should meet two criteria:

1) **Fulfill the Purpose and Need for Change.** A reasonable alternative is one that meets the purpose and need for change for revision of these Forest Plans. The Proposed Action is one way to meet the purpose and need; however, based on how one interprets what is necessary to respond to a need for change, other strategies may also meet that need.

2) **Address the Major Need for Change Issues.** The range of alternatives must also address the major Need for Change issues identified in Chapter 1. The action alternatives are designed to address or resolve one or more of these issues.

Only those alternatives that met the purpose and need for change, and addressed one or more of the major Need for Change issues were considered for detailed study. However, not all possible alternatives that met these criteria were carried into detailed study, as the list of options would have been prohibitively large for detailed study. Instead, the Responsible Official identified those alternatives that both met the criteria and created a reasonable range of outputs, direction, costs, management requirements, and effects from which to consider implementation options. Besides needing to meet the purpose and need and address one or more of the major Need for Change issues, the alternatives considered in detail were further limited in their range by the following factors:

- There are over 78,000 acres in designated Wilderness that do not change by alternative.
- There are over 250,000 acres of habitat for federally listed species with management restrictions that do not change by alternative.
- There are over 60,000 acres of water, stream channel, wetlands, and associated buffer areas with management restrictions that do not change by alternative.
- There are over 70,000 acres of Special Areas (National Recreation Area, Botanical Areas, Scenic Areas, Natural National Landmarks, research areas) that do not change by alternative.
- There are additional acres in eligible Wild and Scenic River corridors and Very High Scenic Integrity corridors with management restrictions that do not change by alternative.

These acres add up to over half of the Forest area, and they have the cumulative effect of reducing management options and narrowing the decision space on remaining Forest lands.

The alternatives considered but eliminated from detailed study are discussed below, followed by those alternatives considered for detailed study.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by the National Environmental Policy Act (NEPA) to explore and objectively evaluate a reasonable range of alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). The alternatives considered but eliminated from detailed study are described below, including a brief discussion of the reason or reasons for elimination.

No Logging/Commercial Harvest

Timber supply is one the major issues analyzed in this EIS, and the alternatives provide a reasonable range of expected commercial harvest. Timber harvesting is a tool necessary to move toward desired conditions stated in the Forest Plan, and therefore a no logging alternative would not meet the purpose and need for this proposal. The range of alternatives has various levels of harvest and degrees of restriction on commercial harvest, and the Preferred Alternative has an estimated 64 percent of the Forest in which no scheduled commercial timber harvest would occur. To analyze an alternative with no logging or commercial harvest would also be inconsistent with the authority provided by Congress, as Congress has clearly indicated that harvesting is allowed on National Forests.

Long Rotations and Individual Tree Selection

A comment on the Draft EIS and Proposed Plan suggested an alternative that would feature 200-300 year harvest rotations and limit timber harvest to individual tree selection across the Forest. The reason for this suggestion would seem to be to provide for an increase in old forest, which the Draft EIS states will increase under all four alternatives considered in detail. Although it has and can be used for many purposes on the Forest, individual tree selection would not achieve the intent of ecosystem restoration expressed in the purpose and need for this proposal, nor achieve the desired conditions for age class or habitat diversity expressed in the Revised Plan. Also, the 200-300 year rotations applied across the entire Forest would likely affect the Forest's ability to provide a sustainable level of timber product, another purpose of this proposal. Finally, we will be likely using individual tree selection and long rotations in some areas of the Forest (e.g., for spruce restoration, Indiana bat habitat, visually sensitive areas), but to apply the same prescription across the entire Forest would be ecologically inappropriate in many cases, and would not provide us with the management flexibility needed to address site-specific conditions and needs. For these reasons, this alternative was not developed and analyzed in detail.

Manage All of the Forest As Wilderness

An alternative that would manage the entire Forest as wilderness is beyond the scope of Plan revision, as only Congress can designate wilderness. Also, the Forest Service, by law and policy, is a multiple-use agency that is mandated to manage numerous programs, many of which would be considered non-conforming uses in wilderness. The alternatives considered in detail provide a reasonable range of backcountry areas and areas recommended for wilderness study. Finally, analysis of such an alternative is not required as it would not meet the purpose and need for the proposal, which is based in NFMA direction to develop an interdisciplinary multiple use framework for future management of multiple use resources (MUSYA, 16 U.S.C. §§ 528, 531).

Do Not Manage Any of the Forest as Wilderness

An alternative that would not manage any of the Forest as wilderness is also beyond the scope of this Plan revision. There are currently over 78,000 acres of Congressionally designated Wilderness on the Forest that must be managed as such by law. The alternatives considered in detail provide a range of recommended wilderness study areas, including the No Action Alternative, which would not recommend any new areas for Congressional designation.

Maintain All Roadless Areas As Roadless

This alternative would have the Forest maintain all roadless areas as roadless. Roadless areas have been inventoried on the Forest a number of times, the most recent being for Forest Plan revision. The Inventoried Roadless Areas are generally not completely roadless, as most have some Maintenance Level 1 and 2 roads within them. However, they are managed to restrict public motorized use, commercial timber harvest, and road construction. The current Inventoried Roadless Areas have a mix of Management Prescriptions 5.1, 6.2 and 8.1 Semi-Primitive Non-Motorized in the Revised Plan. These prescriptions would maintain all of the Inventoried Roadless Areas in their current relatively undeveloped condition. Therefore, it was not necessary to develop and analyze this alternative in detail because the issue is addressed in other alternatives considered in detail.

Create More Early Seral Habitat

Although we have not developed an alternative that focuses solely on creating early seral habitat, all of the alternatives considered in detail would allow for the creation of early seral habitat to some degree. Successional stage amount and distribution is one of the indicators used to display differences in age class diversity across all alternatives in the Vegetation section of Chapter 3.

No New Road Construction and Decommission Existing Roads

Some respondents wanted to see an alternative or alternatives that emphasize no new road construction and the decommissioning or elimination of all unneeded roads and/or roads harmful to the environment. The Wilderness Society, in a report it submitted to the Forest, called *Ecological and Financial Implications of Roads in the Monongahela National Forest* (Fleming et al. 2004), recommended that the Forest: "Ensure that there is no net increase in roads and no new roads in unroaded blocks over 1,000 acres in size until the Forest Service has completed a thorough systematic determination of the minimum road system and identified the objectives for each road." Another recommendation in the report was to: "Consolidate roadless areas and increase the number of large unroaded blocks…by strategically decommissioning and obliterating roads adjacent to and between unroaded blocks." The report also suggested scenarios in which the Forest closes: 1) all of its local roads, or 2) all of its Maintenance Level 1 and 2 roads in order to reduce the costs of road maintenance.

Although these recommended strategies would further The Wilderness Society's goal of maintaining, creating, or enhancing roadless areas across the Forest, they overlook many of the fundamental factors the Forest Service must consider when doing transportation planning, including site-specific information, land allocation implications, and adequate public involvement. To responsibly identify the objective and need for each road on the Forest requires a more in-depth analysis and focused public forum than can be provided during the Plan revision process. To design a Forest-wide transportation system based solely on the need to protect roadless areas or to reduce maintenance costs would be inappropriate at any level. Analyzing and prioritizing transportation system needs for an area as large and complex as the Forest can more properly and effectively be done in smaller incremental stages, using local knowledge and consistent management direction.

The revised Forest Plan has a goal to: "Determine the minimum transportation system necessary to achieve access management objectives", along with direction for achieving this goal. This direction includes evaluating transportation system needs based on "existing uses and condition, environmental and economic impacts, and compatibility with management prescriptions." This level of information is more appropriately obtained at the watershed or project level, with local knowledge and public input. Who is using the roads and why? What are the long-term management and specific access needs for the area? What access options are available and feasible? What uses and options are appropriate given the management prescription of the area? What specific resource impacts are occurring and what options are available for addressing them given the prescription emphasis and direction? These are just some of the questions that can only be meaningfully answered at the local level as part of Plan implementation after the revised Plan is approved.

The Responsible Official elected not to address road management to this detail in the revision process. Attempting to address specific road needs and impacts at the Forest-wide scale would not allow for the local considerations and prioritizations needed to effectively meet environmental, social, economic, and land management issues. Instead, the revision effort focused on providing a consistent broad-scale framework for conducting road planning and management at the watershed and project levels once the Plan is approved.

Travel Management (Public Access)

There were a large number of comments and suggestions related to Travel Management, including comments that the Revision effort should include revising the Forest's Travel Management Plan. However, travel management and allocation of travel "use" zones are not addressed through this forest plan revision process. Travel management will be revised in a separate, more localized, planning process.

The Responsible Official elected not to fully address travel management in this revision process due to the broad array of localized issues with travel management that occurs at scales below a Forest Planning unit. Attempting to address specific travel management issues at the scale of this revision effort would not allow for the localized modifications needed to effectively meet resource, social, and economic issues. However, the Responsible Official does believe that a consistent broad-scale framework for conducting localized travel management planning has been developed in forest plan revision.

This common broad-scale framework in all action alternatives was carried into detailed study and provided what was needed at this scale of analysis to address related Need for Change topics and other issues analyzed in detail. Therefore, alternative localized travel management strategies were not incorporated into revision alternatives considered for detailed study.

No Management Disturbance Above 4,000 Feet

Some respondents wanted to see an alternative that eliminated management-related disturbance within areas above 4,000 feet in elevation due to the sensitivity of these lands. Land managers cannot completely eliminate all management-related disturbance on any part of the Forest, even wilderness. Some disturbance activities—such as trail maintenance, privately owned mineral development, cultural resource surveys, etc.—will and need to occur. However, we do have prescriptions that limit major disturbance activities, like road construction and timber harvest, and these are applied differentially across the alternatives in this EIS. We also developed a specific prescription, 4.1, that limits some management-related disturbances in high-elevation areas on the Forest associated with spruce and spruce-hardwood ecosystems. Therefore, it was not necessary to develop and analyze this suggested alternative in detail.

No Management Within Riparian Areas

Some respondents wanted to see an alternative that eliminated management-related disturbance within riparian areas. Again, land managers cannot completely eliminate all management-related disturbance in riparian areas, as these areas support many other mandated uses and facilities on the Forest, such as campgrounds, gas pipelines, and essential road corridors. We also have management direction that limits specific management-related disturbances in riparian areas and promotes the removal, rehabilitation, or restoration of uses and facilities in these sensitive areas where appropriate. Therefore, it was not necessary to develop and analyze this suggested alternative in detail.

No Management on Areas with Severe Erosion Potential

One respondent wanted to see an alternative that eliminated management-related disturbance on areas with severe erosion potential, as defined by the Forest's soil erosion sensitivity map. Land managers cannot completely eliminate all management-related disturbance on any part of the Forest, including areas with severe erosion potential. We have also conducted management activities in areas with severe erosion potential in the past without measurable adverse effects. The key to operating on sensitive soils is to limit the amount and time of soil exposure to forces of erosion so that the soil does not erode and move off site. We have Forest-wide management direction designed to limit soil exposure and movement, and we can apply additional mitigation measures at the project level if there is an identified need. Therefore, it was not necessary to develop and analyze this suggested alternative in detail.

Custodial Management

One respondent wanted to see an alternative that featured custodial management with greatly reduced levels of timber production (5 million board feet), road building, mining, grazing, prescribed fire, or other management-related disturbance. This alternative would be designed to reduce disturbance to natural resources and provide more of the Forest for old growth, backcountry recreation opportunities, and wilderness experiences.

This alternative was not developed or analyzed in detail for the following reasons:

- We would not likely meet the Purpose and Need for plan revision with a proportionate mix of goods, services, and opportunities,
- We would not approach achieving our desired conditions or goals for vegetation management,
- All of the alternatives considered in detail have management direction and prescriptions that would reduce disturbance to natural resources,
- We already have an alternative that provides an abundance of backcountry recreation opportunities and potential wilderness experiences, and
- To base an entire alternative around an arbitrary harvest production number like 5 MMBF would be unreasonable because, as explained in the EIS (see Timber and Social and Economic Environment sections), we cannot predict the exact amount of timber volume we will produce in any given year due to many variables. Instead, we use ASQ as the maximum amount of timber that could be produced by alternative to indicate the maximum amount of effects that could occur from timber management, and to show differences in alternatives based on suited acres available for harvest, harvest constraints, and our ability to achieve desired conditions for vegetation management.

Reduce Deer and Deer Impacts

This alternative would have the Forest reduce deer populations and associated impacts from deer grazing on tree regeneration, rare plant communities, and wildlife habitat. The management of deer in West Virginia is a cooperative undertaking with the State Division of Natural Resources. The Forest works with the Division to provide or restrict access during deer hunting season, or restrict access to reduce disturbance during other times of the year. To develop an alternative focused upon one very narrow wildlife issue for management of a multiple-use National Forest would not meet the purpose and need of revising the Forest Plan. The effects at the programmatic level of various alternatives on deer populations are disclosed in the FEIS.

Recommend All Inventoried Roadless Areas as Wilderness

An alternative that would recommend all Inventoried Roadless Areas (IRAs) as designated wilderness was considered but eliminated from detailed study. All IRAs were evaluated for wilderness potential, and the Responsible Official considered the evaluations in approving a range of recommended wilderness for the alternatives. Under Alternative 3, the majority of the IRAs are assigned a 5.1 (Recommended Wilderness) prescription, and the rest are assigned a 6.2 (Backcountry Recreation) prescription. Under the preferred alternative, all of the IRAs would be assigned either a 5.1, 6.2, or 8.1 Semi-Primitive Non-Motorized prescription. Management under these prescriptions would essentially maintain wilderness attributes over the planning period, and thus preserve options for Congressional designation in the future.

Benchmark Alternatives

Several “benchmark” alternatives were developed during analysis for the Forest Plan revision. Benchmarks represent maximum production potentials for various resources and uses. Benchmarks were developed for maximum timber production, maximum early-successional habitat, maximum present net value of market values, etc. The benchmark alternatives were eliminated from detailed consideration because they would not provide the mix of resource protection and management. The National Forest Management Act, Multiple-Use Sustained-Yield Act, Endangered Species Act, and other laws and Forest Service policy require that national forests be managed for a variety of uses as well as resource protection.

ALTERNATIVES CONSIDERED IN DETAIL

The Revision Team developed and analyzed in detail four management alternatives for Forest Plan revision. In the descriptions of these alternatives that follow, numbers for Management Prescriptions, road miles, acres of timber harvest, etc. are all best estimates based on the latest available information. The modeling and analyses conducted for this EIS were designed to indicate relative differences between the alternatives rather than predict absolute amounts of activities, outputs, or effects.

Alternatives are described in terms of their dominant themes, and their descriptions identify the issue(s) considered in alternative development and the approach taken by the alternative to address those issues. It is important to remember that not all alternatives address or resolve all issues, but all action alternatives address the Need for Change topics to various degrees. Alternatives are also described by their mix of management emphasis and prescriptions, particularly as they relate to:

- Vegetation diversity and restoration opportunities,
- Suitable timberlands and available timber supply,
- Backcountry recreation opportunities, including recommended wilderness, and
- Soil and water concerns.

The Management Prescriptions are described below in Elements Common to All Alternatives. Each alternative has a table showing acres and percents of MP allocations for that alternative.

Elements Common to All Alternatives

The alternatives considered in detail all have elements in common. For instance, they meet the Purpose and Need of this action, and they address the major issues to various degrees. They share the same affected areas within and surrounding the Forest boundaries, and comply with federal and state laws and regulations. In addition, these alternatives are comprised of various combinations of the Management Prescriptions described below.

Management Prescriptions

Management Prescriptions (MPs) were assigned to National Forest System lands based roughly on category descriptions that the Forest Service has developed at the national level. The MPs represent management emphasis themes, ranging from areas with little or no development, such as Designated Wilderness (5.0) or Recommended Wilderness (5.1), to areas where a relatively high degree of development may be expected over time, such as Developed Recreation (7.0) or Age Class Diversity (3.0). Different combinations of MPs were assigned to alternatives to reflect the overall management themes and relative differences in the management emphasis of those alternatives.

It is important to note, however, that not every acre of every prescription area may reflect the MP emphasis. For instance, some prescription areas are intersected by administrative boundaries that have specific management requirements that may or may not match the overall MP. Eligible Wild and Scenic River corridors are examples of these administrative areas. These areas would be managed according to their classification standards, as described in the Wild and Scenic River Act, regardless of the MP that surrounds them.

Riparian areas within channel or wetland buffers would also receive special management consideration, regardless of the surrounding MP. These considerations are described in the management direction of the 1986 and revised Forest Plans.

Additionally, there are many smaller administrative units, with or without official designation, which may have management requirements that are somewhat different than the overall management emphasis of the MP. Examples of these units include developed administrative sites, recreation sites, designated utility corridors or communication sites, mines, and cultural or historical sites.

For instance, a campground would be managed as a campground, regardless of the MP. Mineral development opportunities are determined to a large extent by the Mining Leasing Act, other legislation, and deed terms. However, the amount or timing of operations for federally leased minerals could be influenced by specific MP management direction.

Most cultural and historic sites are protected, particularly if they are eligible for or listed on the National Register of Historic Places. MP assignments would not affect these sites, but they could affect the settings around or access to these sites.

MPs applied to the alternatives are described below. More detailed descriptions can be found in the 1986 and Revised Forest Plans' Management Prescription sections.

1.1 – Mineral Development. This prescription applies to areas dominated by mineral extraction operations such as mines, compressor stations, coal-washing facilities, and associated roads and utilities. Timber products and motorized recreation are other resources or uses expected in this area. This MP was described in the 1986 Plan but no lands were allocated to it at that time or in the intervening years. As most mineral development occurs as points or lines on the map, and there is little management direction applied to privately owned mineral development, there was no reason to carry this MP forward into revision as part of the analysis.

2.0 – Uneven-aged Timber Management. This prescription applies to areas suitable for hardwood timber production. They generally have slopes less than 60 percent and no factors limiting management of the area or reforestation efforts. The timber types must be suitable for management by the uneven-aged silvicultural system. A relatively high degree of activity typically occurs, including roads open to public use, recreation areas, mineral exploration, grazing allotments, and special use permits. This prescription is considered suited timberland, and forest products are provided through active management.

3.0 – Age Class Diversity. This prescription applies to lands managed primarily to create and maintain a variety of forest age classes to provide sustainable forest products and a range of recreational settings, visual landscapes, and wildlife habitat. This prescription is considered suited timberland, and forest products are provided through active management.

4.0 – Conifer Management. This prescription applies to lands that are dominated by existing conifer or mixed hardwood-conifer stands. It emphasizes a variety of coniferous forest views, a primarily motorized recreational environment, wildlife habitat and species associated with conifers, and production of softwood trees for fiber and lumber. This prescription is considered suited timberland, and forest products are provided through active management.

4.1 – Spruce and Spruce-Hardwood Restoration. This management prescription focuses on restoration and management of the red spruce and spruce-hardwood communities on the Forest. This prescription emphasizes passive and active restoration of spruce and spruce-hardwood communities, research on spruce restoration, recovery of community-related species of concern, and more active management of hardwood communities where the spruce component is negligible or absent. The portion of this prescription outside of suitable habitat for West Virginia northern flying squirrel is generally considered suited timberland.

5.0 – Designated Wilderness. This prescription applies to lands that are designated by Congress as Wilderness. The main management emphasis is preserving wilderness attributes, including natural appearance, natural integrity, opportunities for solitude, opportunities for primitive recreation, and identified special features. The area is managed to allow natural processes to prevail, with little or no evidence of human development.

5.1 – Recommended Wilderness. This prescription applies to lands that the Forest Service recommends for Wilderness study. The primary management emphasis is to maintain wilderness attributes until Congress decides to designate the areas as wilderness or release them to some other form of management. Although these areas do not fall under the authority of the Wilderness Act, they are managed to maintain wilderness attributes where feasible, and to generally allow natural processes to prevail.

6.1 – Wildlife Habitat Emphasis. This prescription applies to lands where vegetation management emphasizes wildlife habitat diversity and sustainable mast production. Generally low levels of disturbance for wildlife and fish species are provided through access restrictions and a network of security areas. The recreational setting is primarily non-motorized, though some areas are open for motorized opportunities. This prescription is considered suited timberland, and forest products are provided through active management.

6.2 – Backcountry Recreation. This prescription applies to lands that emphasize a semi-primitive, non-motorized setting with a variety of dispersed recreation opportunities. The area has a natural-appearing environment with relatively little sign of management-related disturbance. This prescription is considered not suited for timber production, and programmed timber harvest is not expected to occur.

6.3 – Indiana Bat Habitat. This prescription was developed for the 2004 Threatened and Endangered Species Forest Plan Amendment to provide specific management direction for the primary ranges of Indiana bat. This direction promotes bat habitat maintenance or enhancement, reduces disturbance to bats and important habitat features, and is applied as an overlay to all other prescriptions except 5.0, 6.2, and 8.0. This prescription only exists for Alternative 1, No Action. For the Action Alternatives the 6.3 prescription was replaced by Forest-wide direction.

7.0 – Developed Recreation. This prescription applies to lands where developed recreation is the primary emphasis. These lands are typically characterized by substantial recreation-related infrastructure and capital investment. Facilities are maintained, and both motorized and non-motorized recreation opportunities may be provided. Multiple uses—such as timber harvest, mining, and grazing—are typically restricted where they may compromise recreation values. Human use and presence are obvious. The areas may have a substantially modified natural environment. Vegetative treatments may occur to achieve desired conditions and to reduce the risk of impacts from insects, diseases, and fire on recreation settings and developments.

8.0 – Special Areas. This prescription applies to lands that emphasize the preservation of special ecosystems, areas for scientific research, or areas with national significance. The areas included in this prescription are scattered throughout the Forest and are of various sizes. Their special characteristics are recognized by a variety of administrative designations. Areas in this prescription include Botanical Areas, Scenic Areas, National Natural Landmarks, candidate Research Natural Areas, the Fernow Experimental Forest, Grouse Management Areas, and the Spruce Knob – Seneca Rocks National Recreation Area (NRA).

9.0 – Areas Unsuited for Management and Investment. This prescription applies to lands where it is not appropriate to make capital investments. Included are environmentally sensitive lands such as steep slopes, wetlands, or rocky areas. Also included are lands where tree regeneration cannot be ensured, such as rhododendron thickets, or lands where desired resource benefits can be maintained efficiently without intensive management. This prescription was described in the 1986 Plan but no lands were allocated at that time or in the intervening years, so there was no reason to carry it forward into revision as part of the analysis. Unsuited lands can still be identified at the project level with site-specific information without a separate MP.

Wilderness

The Forest currently has five Congressionally designated Wildernesses: Dolly Sods, Cranberry, Otter Creek, and Laurel Fork North and South. These Wildernesses do not vary by alternative.

Wilderness Acre Change – For the DEIS and Proposed Revised Forest Plan, we used the original acreage measured for Wildernesses back in 1986; 78,131 acres. However, we have since decided to use the acreage as measured by 2006 GIS technology for consistency and accuracy in our EIS analyses. This number is typically rounded off to 78,700 in the FEIS and applied to all alternatives.

Eligible Wild and Scenic Rivers

The Forest currently has 12 river segments that are considered eligible for inclusion in the National Wild and Scenic River System (see map packet). These eligible rivers do not vary by alternative. Although the river corridors do not have their own MP, the corridor areas have been removed from the suitable timber base where they occur in MPs that have lands considered suitable. Information on the eligible rivers is provided in the MPs of Chapter III of the 2006 Forest Plan.

Special Areas

The Forest currently has many Special Areas (National Recreation Area, Botanical Areas, Scenic Areas, Natural National Landmarks, Fernow Experimental Forest, etcetera) that do not vary by alternative. Under Alternative 3, a portion of the NRA would be assigned a Recommended Wilderness (5.1) Management Prescription, but this portion would remain part of the NRA.

Alternative 1 (No Action)

This is the No Action Alternative that provides the baseline for the effects analysis in this EIS. "No Action" for this alternative means continuing current management of the Forest, while updating Forest Plan direction from six Forest Plan amendments that have occurred since 1986. Alternative 1 does not attempt to address Need for Change topics described in Alternative 2.

The most recent Forest Plan amendment, the Threatened and Endangered Species Amendment (2004), resulted in substantial changes to the management direction and prescriptions as depicted in the 1986 Plan. The amendment created a new 6.3 Management Prescription (MP) area to represent the primary ranges of Indiana bat. The 6.3 MP comprises 136,000 acres and has direction with specific restrictions on a wide range of management activities.

The amendment also clearly defined Opportunity Area (OA) 832 to represent suitable habitat for West Virginia northern flying squirrel. OA 832 area was listed in the 1986 Plan as part of the 8.0 prescription, but no specific area, acreage, or management direction was associated with it. The amendment OA 832 area is over 117,000 acres, and has specific restrictions on vegetation management and other activities.

The amendment stated that the 6.3 and OA 832 prescriptions were to be used as overlays of management direction on existing management prescriptions (except for MPs 5.0, 6.2 and 8.0), rather than as replacement prescriptions. The 1986 MPs, prior to the amendment, are shown on a map in the map packet. However, overlaying this direction on the existing 3.0 and 6.1 prescriptions fundamentally changes the way the Forest is able to manage those 1986 prescriptions. The management emphasis shifts from age class diversity and timber production in 3.0, or wildlife habitat emphasis with timber production in 6.1, to enhancing bat habitat in 6.3, and little or no vegetation management in OA 832. Therefore, the 6.3 and OA 832 areas are shown as replacement or new MPs for Alternative 1 (see Alternative 1 map in EIS map packet). Alternative 1 as depicted here and in the map packet is the No Action Alternative that will be analyzed in Chapter 3 of this EIS.

The Major Issues and the Management Prescriptions

Management prescriptions that appear in Alternative 1 in the map packet represent the 1986 Forest Plan as amended, and they are somewhat different than the prescriptions used in the Action Alternatives (2-4), which are described in the Revised Plan. Alternative 1 has MPs 2.0, 4.0, 6.3, 7.0, and OA 832, which are not used in Alternatives 2-4. Alternative 1 does not have MPs 4.1, 5.1, and 8.1 (the NRA), which are used in Alternatives 2-4. Displayed as a percent of the Forest, the major management prescriptions under Alternative 1 are:

- 6.1 – Wildlife Habitat Diversity (31.0 percent)
- 3.0 – Age Class Diversity (15.0 percent)
- 6.3 – Indiana Bat Primary Range (14.9 percent)
- 8.0 – Special Areas (14.2 percent)
- 6.2 – Backcountry Recreation (13.6 percent)
- 5.0 – Designated Wilderness (8.6 percent).

Vegetation Management – Management is focused in two Management Prescriptions, 6.1 and 3.0. Two other prescriptions (2.0 and 4.0) are considered suitable for timber production, but they are very small in size and have not been utilized extensively since the 1986 Plan was released. The 6.1 and 3.0 MPs have been managed somewhat differently than predicted in the 1986 Plan. In many cases, Forest managers have found that 6.1 areas were more suited to 3.0 silvicultural prescriptions, and have applied more clearcutting with reserve trees and two-aged treatments in 6.1 than 3.0. Overall, vegetation management has included a high percentage of commercial thinning, shelterwood, and two-aged cuts, with a very low percentage of complete overstory removal or clearcuts. Timber management has not achieved the age class diversity predicted in the 1986 Plan, and there has been little or no emphasis on vegetation restoration. Passive restoration of spruce and spruce-hardwood forests would occur across most of Opportunity Area 832, which is suitable habitat for West Virginia northern flying squirrel. OA 832 comprises roughly 115,500 acres, or about 13 percent of the Forest.

Also, there is currently an annual allowance of up to 6,000 acres treated by timber harvest and 300 acres treated by prescribed fire due to the USDI Fish and Wildlife Service's Biological Opinion and Incidental Take Statement (March 2002) for the Threatened and Endangered Species Amendment to the Forest Plan. It is estimated that timber harvest and prescribed fire levels will not need to exceed the annual allowances in the Incidental Take Statement. The Spectrum model predicts that an annual average of 5,482 acres would need to be treated to achieve the Allowable Sale Quantity and desired conditions over time in Alternative 1. Prescribed fire has been limited to a maximum annual average of 300 acres for this alternative.

Timber Supply – There are an estimated 332,200 acres of suited timberlands (36 percent of the Forest) in this alternative, and the maximum timber volume to be produced from those acres is estimated at 10.8 MMCF (65 MMBF) per year. Management Prescriptions associated with suited timberlands (2.0, 3.0, 4.0, 6.1, 6.3) represent the most likely areas where localized harvest-related activities may occur. Within these MPs, however, are many areas where timber production will not occur on a regulated basis, including roads, waterways, stream channel and wetland buffers, recreation and administrative sites, cultural resource sites, mining sites, habitats for listed species, extremely steep or rocky areas, and areas that have restricted access.

Backcountry Recreation - Management Prescriptions that emphasize undeveloped recreation (6.2, 5.0) comprise an estimated 22 percent of the Forest. No areas would be recommended for wilderness (MP 5.1) under Alternative 1, as no areas were recommended in the 1986 Forest Plan. Existing Wildernesses are managed to preserve wilderness values. The 6.2 areas are managed as remote backcountry in a Semi-Primitive Non-Motorized setting, although roads exist in many areas and can be used for administrative access.

Water and Soil – Management Prescriptions that would have low potential for management-related disturbance to soil and water resources (5.0, 6.2, and 8.0, including WVNFS suitable habitat) comprise an estimated 36 percent of the Forest. Other lands considered unsuited for commercial timber production (Stream buffer zones, scenic corridors, etc.) comprise another 26 percent of the Forest. Additional inventory, mitigation, and monitoring may also be applied in areas where management actions have the potential to contribute to soil nutrient depletion related to acid deposition concerns. Riparian Management Guidelines were developed in 1999 to be used as project-specific mitigation on the Forest but were never officially incorporated into Forest Plan direction.

Twelve river segments are considered eligible for National Wild and Scenic River designation. None of the river segments would be recommended for designation at this time, but they would remain eligible for future designation. Their free-flowing status and visual quality would be managed and protected under a Wild classification until a suitability study determined they were no longer eligible, or they were recommended to Congress for designation. At present, most of the segments do not meet Wild classification criteria.

Table 2-1 shows acres of MPs by Forest for Alternative 1. See Alternative 1 Map, in the EIS map packet, for MP spatial distribution. Acres are rounded off to the nearest hundred.

Table 2-1. Management Prescription Acres for Alternative 1

Number	Management Prescription	Acres	Percent of Forest
2.0	Uneven-aged Management	13,700	1.5
3.0	Age Class Diversity	137,000	15.0
4.0	Conifer Management	400	0
5.0	Designated Wilderness	78,700	8.6
5.1	Recommended Wilderness	0	0
6.1	Wildlife Habitat Diversity	284,400	31.0
6.2	Backcountry Recreation	124,500	13.6
6.3	Indiana Bat Primary Range	136,100	14.9
7.0	Developed Recreation	1,100	0.1
8.0	Special Areas*	130,500	14.2
None	Areas that were not assigned an MP	9,700	1.1

*An estimated 89% of this prescription is Opportunity Area 832, a zoological area, which represents suitable habitat for the West Virginia northern flying squirrel, as applied in the 2004 T&E Amendment to the 1986 Plan

Alternative 2

Alternative 2 is the proposed action that was designed to address the Need for Change topics that initiated Forest Plan revision. The Need for Change topics are described below, along with how they are addressed. For a more complete description of how Need for Change was addressed, see Appendix C of the Revised Forest Plan.

Some features of Alternative 2 represent little change or maintain the status quo relative to the No Action Alternative. For example, recreation uses and opportunities stay much the same, as do rangelands considered suitable for livestock grazing. For a more detailed description and comparison of changes from No Action to Proposed Action, see the Comparison of Alternatives section, later in this chapter, and the effects analyses of the alternatives in Chapter 3 of this EIS.

Major Need For Change Topics

Vegetation Management – The Need for Change identified for this topic was:

- Provide direction for desired species composition and age classes of forest communities, and distribution across the landscape. This direction should include consideration for the diversity of wildlife habitats that these communities provide, from openings to old forests.

Direction for desired species and age classes was provided at the Forest-wide and MP levels. This direction emphasizes diversity across the landscape for forest ecosystems and the habitats they provide. This direction would apply to all alternatives but would vary somewhat between alternatives depending on the allocation of Management Prescriptions.

- Provide direction that will allow for long-term forest health and sustainability, including restoration of declining communities, and the role of disturbances on the landscape.

Direction was provided for forest health and sustainability at the Forest-wide and MP levels. Forest-wide direction addresses age class distribution, non-native invasive species, rare plant communities, pest management, and fuels treatment to help maintain healthy and diverse forests. The 4.1 MP was created to help restore and maintain spruce and spruce-hardwood ecosystems. The 6.1 MP was updated to include an emphasis on restoration of oak-pine and oak-hickory communities, and an increased role for fire as a disturbance agent to help maintain desired conditions. This direction and these MPs would be applied to all action alternatives. The amount and location of MPs vary by alternative, depending on the alternative theme/emphasis.

- Update Forest-wide and Management Prescription direction to address appropriate silvicultural and resource protection methods.

This direction was updated and integrated across a variety of resource areas, and it would be applied equally to all action alternatives.

- Develop direction to address the emerging concern of non-native invasive plant species.

This direction was developed for the Revised Plan and would be applied equally to all action alternatives.

- Develop direction to maintain or restore rare plants and communities, including Regional Forester Sensitive Species.

This direction was developed for the Revised Plan and would be applied equally to all action alternatives.

Backcountry Recreation – The Need for Change identified for this topic was:

- Update 6.2 MP direction as needed and consider adjusting allocations of 6.2 based on the roadless/wilderness evaluation, the Recreation Opportunity Spectrum Map, and a reasonable range of backcountry recreation opportunities for the Responsible Official to consider.

The 6.2 MP direction and allocations were updated to reflect national and regional direction. Land allocations were adjusted based on the roadless/wilderness evaluation. For this alternative, all lands that qualified as Inventoried Roadless Areas were given a 6.2 or 5.1 prescription. Lands that did not qualify for the inventory, usually because of small size and/or development impacts, were given different prescriptions (see Appendix C). An estimated 21,462 acres of MP 6.2 in the Spruce Knob–Seneca Rocks NRA were given a different prescription but will still be managed for backcountry recreation under a Semi-Primitive Non-Motorized (SPNM) ROS setting.

- Develop a new Management Prescription (5.1) for Recommended Wilderness, and provide a range of wilderness recommendations for the Responsible Official to consider.

The 5.1 MP was developed, and a range of recommended wilderness was provided across the alternatives based on an evaluation of wilderness potential. A new roadless area inventory was conducted to determine the best potential pool of wilderness potential on the Forest. This inventory becomes the new set of 6.2 MP areas under Alternative 2, except for four of the areas, which are recommended for Wilderness under the 5.1 MP.

Water and Soil – The Need for Change identified for this topic was:

- Review and update Riparian Management Guidelines that were developed in 1999 to be used as project-specific mitigation on the Forest. Incorporate into the revised Forest Plan as needed.

The 1999 Riparian Management Guidelines and other relevant sources of direction were reviewed and incorporated as needed into the revised Plan to provide for stream channel and wetland protection. A new section in the Forest-wide direction of the revised Plan was created, and this direction would apply to Alternatives 2 , 3, and 4.

- Update Forest-wide and Management Prescription direction to provide for adequate protection of soils, water quality, and fish habitat.

Forest-wide and MP direction was updated to provide for soil, water, and fish habitat protection. The Forest-wide soil and water direction was combined into one section with the stream channel and wetland direction described above. This direction would apply to Alternatives 2, 3, and 4.

- Address acid deposition and sedimentation concerns through additions to Forest-wide direction and monitoring, and analyze the EIS alternatives based on their potential to influence these concerns.

Additional direction and monitoring was created or incorporated to address acid deposition and sedimentation concerns. This direction and monitoring would apply to all action alternatives. The EIS alternatives are analyzed based on their potential to influence these concerns.

Although no alternative was solely developed to address these concerns, all alternatives have MPs (5.0, 5.1, 6.2, 8.0) that would reduce the potential for ground disturbance that could directly affect these concerns. The 4.1 MP was also developed as a means of limiting disturbance in high-elevation spruce and spruce-hardwood ecosystems where acid deposition on susceptible land types and sedimentation in trout stream headwaters is of particular concern. The 4.1 MP is applied to all action alternatives, although the amount and locations vary by alternative.

Timberland Supply – The Need for Change identified for this topic was:

- Revisit suitable lands determination, revise supply and demand estimations, and recalculate ASQ based on those changes.

Timberland capability and suitability were re-assessed for Forest Plan revision (see *Timber Supply* section, Chapter 3). This assessment applies to all alternatives, however suitability was further refined in the action alternatives through the allocation of MPs. Specific MPs (3.0, 4.1, and 6.1) contain suited timberlands, although each MP has a somewhat different emphasis for vegetation management (see MP descriptions, this chapter). These MPs are applied to all action alternatives, but by differing amounts and locations. The ASQ was calculated for all of the alternatives based on timber suitability, MP allocations, and Forest-wide and MP direction constraints.

<u>Minor Need For Change Topics</u>

Need for Change was identified for a number of other topics as well. For the most part, these changes were initiated in Alternative 2 but apply to Alternatives 3 and 4 as well. They include:

- The Scenery Management System has replaced the Visual Quality Objective System.
- The Forest-wide Monitoring and Evaluation Plan has been updated.
- Heritage Resource direction has been updated to address changes in the program since 1986.
- Land acquisition priorities have been updated, and new lands acquired since 1986 have been given a Management Prescription.
- Fire management direction has been broadened to incorporate fire as a management tool.
- Management Indicator Species have been reviewed and changed where needed to better reflect a cause-effect relationship with management activities (see Appendix D).

- The Forest Opportunity Areas have been replaced by an emphasis on watershed-based analysis and management.
- Editorial and formatting changes have been made to make the Plan easier to read, understand, and implement.
- A Species Viability Evaluation was completed to help ensure that viable populations of species are provided for under the Forest's multiple use management.
- Information on eligible Wild and Scenic Rivers was updated and incorporated into the 2006 Plan, including the strategy to manage for the rivers' highest potential classification, as opposed to the "Wild" classification management strategy applied in the 1986 Plan.
- The Spruce Knob–Seneca Rocks NRA was given its own Management Prescription.
- MPs (1.1, 2.0, 4.0, 9.0) that were outmoded or not used to manage resources were eliminated.
- Forest Plan amendments were incorporated into the Revised Forest Plan where appropriate.

The Major Issues and the Management Prescriptions

Management Prescriptions are somewhat different than those used in Alternative 1, which are described in the 1986 Forest Plan. MPs 2.0, 4.0, 6.3, and 7.0 are no longer used. Opportunity Area 832, representing West Virginia northern flying squirrel suitable habitat, has been replaced by MP 4.1. Forest lands within the NRA have been given a new MP, 8.1. Displayed as a percent of the Forest, the major management prescriptions under Alternative 2 are:

6.1 – Wildlife Habitat Diversity (31.3 percent),
3.0 – Age Class Diversity (21.5 percent)
4.1 – Spruce and Spruce Hardwood Restoration (17.0 percent)
6.2 – Backcountry Recreation (10.6 percent)
5.0 – Designated Wilderness (8.6 percent)
8.0 – Special Areas (8.0 percent)
5.1 – Recommended Wilderness (3.0 percent)

Vegetation Management – Specific desired conditions, goals, and objectives for age class diversity, species composition, and vegetation components were developed at the Forest-wide and Management Prescription levels. Management Prescriptions 2.0 and 4.0 were determined to be unnecessary and were eliminated. Prescriptions areas for 6.1 and 3.0 were shifted around somewhat to better reflect the potential for different types of vegetation management. MP 6.1 was revised, and MP 4.1 was created to emphasize restoration of declining or recovering forest communities. Forest-wide direction was created to address non-native invasive species and rare plants and communities, with the intent to enhance the diversity and sustainability of forest ecosystems. There is currently an annual allowance of up to 6,000 acres treated by timber harvest and 300 acres treated by prescribed fire due to the USDI Fish and Wildlife Service's Biological Opinion and Incidental Take Statement (March 2002) for the Threatened and Endangered Species Amendment to the Forest Plan. It is estimated that timber harvest levels will not need exceed the annual allowance of 6,000 acres. However, to help achieve desired oak ecosystem restoration, the Forest is proposing to increase the prescribed fire allowance to 30,000 acres per decade (an average of 3,000 acres a year).

Timber Supply – There are an estimated 330,300 acres of suited timberlands (36 percent of the Forest) in this alternative, and the maximum timber volume to be produced from those acres is estimated at 10.5 MMCF (63 MMBF) per year. Management Prescriptions that have suited timberlands within them (3.0, 4.1, 6.1) represent the most likely areas where localized harvest-related activities may occur. Within these MPs, however, are many areas where timber production will not occur on a regulated basis, including roads, waterways, stream channel and wetland buffers, recreation and administrative sites, cultural resource sites, mining sites, some habitats for listed species, extremely steep or rocky areas, and areas that have restricted access.

Backcountry Recreation - Management Prescriptions that emphasize undeveloped recreation (6.2, 5.0, 5.1, 8.1 SPNM) comprise an estimated 25 percent of the Forest. Four areas (3 percent of the Forest) are recommended for wilderness study (MP 5.1). These areas are Cheat Mountain, Cranberry Expansion, Dry Fork, and Roaring Plains West. They are managed to maintain their wilderness potential. Existing Wildernesses are managed to preserve wilderness values. The 6.2 areas are managed as remote backcountry in a Semi-Primitive Non-Motorized setting, although roads exist in many areas and can be used for administrative and authorized access.

Water and Soil – Management Prescriptions that would have low potential for management-related disturbance to soil and water resources (5.0, 5.1, 6.2, 8.1 SPNM, 8.2, 8.3, 8.4, 8.5) comprise an estimated 25 percent of the Forest. Other lands considered unsuited for commercial timber production (T&E species habitat, stream buffer zones, scenic corridors, etc.) comprise another 37 percent of the Forest. Additional inventory, mitigation, and monitoring may also be applied in areas where management actions have the potential to contribute to soil nutrient depletion related to acid deposition concerns.

Table 2-2 shows acres of MPs by Forest for Alternative 2. See Alternative 2 Map, in the EIS map packet, for MP spatial distribution. Acres are rounded off to the nearest hundred.

Table 2-2. Management Prescription Acres for Alternative 2

Number	Management Prescription	Acres	Percent of Forest
3.0	Age Class Diversity	196,900	21.5
4.1	Spruce and Spruce-Hardwood Restoration	155,700	17.0
5.0	Designated Wilderness	78,700	8.6
5.1	Recommended Wilderness*	27,700	3.0
6.1	Wildlife Habitat Diversity	286,600	31.3
6.2	Backcountry Recreation	97,500	10.6
8.0	Special Areas	73,600	8.0

*Recommendations for Wilderness under any alternative are preliminary administrative recommendations only. Any recommendation would receive further review and possible modification by the Chief of the Forest Service, the Secretary of Agriculture, and the President of the United States. Congress has reserved final decisions to designate Wilderness to the National Wilderness Preservation System.

Alternative 2 Modified (2M)

This alternative is a modified version of Alternative 2 in the Draft EIS. The modifications are a direct result of comments received on the Draft EIS and Proposed Revised Forest Plan. Management direction changes to the Proposed Revised Forest Plan have been applied to the 2006 Revised Forest Plan and now pertain to all of the action alternatives (2, 2M, 3, and 4) Management prescription changes to Alternative 2 have only been applied to Alternative 2M. We chose to create a new alternative for the Final EIS so that the reader could easily see the degree of change between Alternative 2, the proposed action and preferred alternative in the Draft EIS, and Alternative 2M, the preferred alternative in the Final EIS. The Management Prescription changes between Alternative 2 and Alternative 2M are briefly described below.

MP Changes as a Result of Comments on the Draft EIS

1) The area surrounding the Big Run Bog National Natural Landmark changed from MP 6.1 to MP 4.1 to reflect the high percentage of conifer and potential West Virginia northern flying squirrel habitat in the area. Big Run Bog remained an 8.2 National Natural Landmark.

2) The Weiss Knob area changed from MP 6.1 to MP 4.1 to reflect the high percentage of conifer and potential West Virginia northern flying squirrel habitat in the area.

3) The area around Haystack Knob/Hoffman Ridge changed from MP 6.1 to MP 5.1, part of the Roaring Plains West area recommended for wilderness study. Due to a mapping error in the Draft EIS, this area was incorrectly colored and labeled as MP 6.1, even though the acres of the area were included in the acreage of the Roaring Plains West MP 5.1.

4) The spruce portion of Barlow Top changed from MP 3.0 to MP 4.1 to reflect the high percentage of conifer and potential West Virginia northern flying squirrel habitat in the area.

5) The Pike Knob area changed from MP 6.1 to MP 8.5 (Candidate Research Natural Area) to better preserve and study the assemblage of rare plants and plant communities in the area.

6) The Lower Laurel Fork area changed from MP 6.1 to MP 6.2 to reflect the high recreational values of the area, including a river corridor that is currently considered eligible for inclusion in the Wild and Scenic River system. This corridor is classified as "Wild".

7) The Roaring Plains North area changed from MP 4.1 to MP 6.2 and was added to the Roadless Area Inventory to maintain its wilderness potential and attributes.

8) The Roaring Plains East area changed from MP 4.1 and MP 6.1 to MP 6.2 and was added to the Roadless Area Inventory to maintain its wilderness potential and attributes.

9) The Loop Road Research Area changed from MP 4.1 to MP 8.5 to protect the ongoing research studies in the area.

10) A small portion of the Dry Fork area changed from MP 5.1 to MP 6.1 in order to exclude an open road in this area that has been recommended for wilderness study.

The changes described above resulted in the following cumulative changes to Alternative 2M when compared to Alternative 2:
- MP 3.0 decreased approximately 1,800 acres
- MP 4.1 decreased approximately 1,200 acres
- MP 6.1 decreased approximately 8,200 acres
- MP 6.2 increased approximately 8,200 acres
- MP 8.0 increased approximately 2,900 acres.

The Major Issues and the Management Prescriptions

Management Prescriptions are similar to those in Alternative 2 but allocations are different. Displayed as a percent of the Forest, the management prescriptions under Alternative 2M are:
6.1 – Wildlife Habitat Diversity (30.3 percent),
3.0 – Age Class Diversity (21.2 percent),
4.1 – Spruce and Spruce Hardwood Restoration (16.8 percent),
6.2 – Backcountry Recreation (11.7 percent),
5.0 – Designated Wilderness (8.6 percent),
8.0 – Special Areas (8.4 percent),
5.1 – Recommended Wilderness (3.0 percent).

Vegetation Management – Management Prescriptions that emphasize restoration of vegetation conditions (4.1, 6.1) comprise an estimated 47 percent of the Forest. Forest-wide direction addresses non-native invasive species and rare plants and communities, with the intent to enhance the diversity and sustainability of forest ecosystems. It is estimated that timber harvest levels will not need exceed the annual allowance of 6,000 acres. However, to help achieve desired oak ecosystem restoration, the Forest is proposing to increase the prescribed fire allowance to 30,000 acres per decade (an average of 3,000 acres a year).

Timber Supply – There are an estimated 329,400 acres of suited timberlands (36 percent of the Forest) in this alternative, and the maximum timber volume to be produced from those acres is estimated at 10.5 MMCF (63 MMBF) per year. Management Prescriptions that have suited timberlands within them (3.0, 4.1, 6.1) represent the most likely areas where localized harvest-related activities may occur. Within these MPs, however, are many areas where timber production will not occur on a regulated basis, including roads, waterways, stream channel and wetland buffers, recreation and administrative sites, cultural resource sites, mining sites, some habitats for listed species, extremely steep or rocky areas, and areas that have restricted access.

Backcountry Recreation - Management Prescriptions that emphasize undeveloped recreation (6.2, 5.0, 5.1, 8.1 SPNM) comprise an estimated 26 percent of the Forest. Four areas (3 percent of the Forest) are recommended for wilderness study (MP 5.1). These areas are Cheat Mountain, Cranberry Expansion, Dry Fork, and Roaring Plains West. They are managed to maintain their wilderness potential. Existing Wildernesses are managed to preserve wilderness values. The 6.2

areas are managed as remote backcountry in a Semi-Primitive Non-Motorized setting, although roads exist in many areas and can be used for administrative and authorized access.

Water and Soil – Management Prescriptions that would have low potential for management-related disturbance to soil and water resources (5.0, 5.1, 6.2, 8.1, 8.2, 8.3, 8.4, 8.5) comprise about 27 percent of the Forest. Other lands considered unsuited for commercial timber production (T&E species habitat, stream buffer zones, scenic corridors, etc.) comprise another 36 percent of the Forest. Additional inventorying, mitigation, and monitoring may also be applied in areas where management actions have the potential to contribute to soil nutrient depletion related to acid deposition concerns.

The Table 2-3 shows acres of MPs by Forest for Alternative 2 Modified. See Alternative 2M Map in the map packet for MP spatial distribution. Acres are rounded off to the nearest hundred.

Table 2-3. Management Prescription Acres for Alternative 2 Modified

Number	Management Prescription	Acres	Percent of Forest
3.0	Age Class Diversity	194,600	21.2
4.1	Spruce and Spruce-Hardwood Restoration	153,600	16.8
5.0	Designated Wilderness	78,700	8.6
5.1	Recommended Wilderness*	27,700	3.0
6.1	Wildlife Habitat Diversity	277,600	30.3
6.2	Backcountry Recreation	106,800	11.7
8.0	Special Areas	77,400	8.4

*Recommendations for Wilderness under any alternative are preliminary administrative recommendations only. Any recommendation would receive further review and possible modification by the Chief of the Forest Service, the Secretary of Agriculture, and the President of the United States. Congress has reserved final decisions to designate Wilderness to the National Wilderness Preservation System.

Alternative 3

Alternative 3 emphasizes backcountry recreation opportunities and reduces management-related disturbance across the Forest. Recreation emphasis is on semi-primitive, non-motorized settings and opportunities. This alternative features the most area in recommended wilderness (5.1) and backcountry recreation (6.2) prescriptions of all the alternatives considered in detail. Vegetation management activities are similar to those for Alternative 2; however, they are limited in scope to a much smaller suited timber base.

Issues Used to Develop this Alternative

Soil and Water Issue: Compared to the Proposed Action, Alternative 3 provides more emphasis on the passive conservation and restoration of soil, water, riparian and aquatic resources by increasing MP 6.2 and 5.1 allocations by almost 200,000 acres across the Forest. Because these MPs have a very low potential for management-related disturbance activities (road construction, timber harvest, federal mineral leasing surface occupancy, recreation facility development), the potential for ground disturbance contributing to nutrient depletion and sedimentation concerns would be reduced.

Backcountry Recreation Issue: Compared to the Proposed Action, Alternative 3 substantially increases acres in MPs 5.1 and 6.2 that emphasize backcountry recreation opportunities. As noted above, this increase is nearly 200,000 acres. Alternative 3 also has the most area (99,400 acres) recommended for wilderness study of all the alternatives considered in detail.

The Major Issues and the Management Prescriptions

Management Prescriptions are similar to those in Alternative 2, but allocations are different. Displayed as a percent of the Forest, the major MPs under Alternative 3 are:

- 6.2 – Backcountry Recreation (24.7 percent),
- 3.0 – Age Class Diversity (20.0 percent),
- 6.1 – Wildlife Habitat Diversity (19.4 percent),
- 5.1 – Recommended Wilderness (10.9 percent),
- 4.1 – Spruce and Spruce Hardwood Restoration (9.8 percent),
- 5.0 – Designated Wilderness (8.6 percent),
- 8.0 – Special Areas (6.6 percent).

Vegetation Management - Management Prescriptions that emphasize restoration of vegetation conditions (4.1, 6.1) comprise an estimated 29 percent of the Forest. MPs 6.1 and 4.1 emphasize restoration of declining or recovering forest communities. Forest-wide direction addresses non-native invasive species and rare plants and communities, with the intent to enhance the diversity and sustainability of forest ecosystems. Vegetation management has an annual allowance of up to 6,000 acres treated by timber harvest and 300 acres treated by prescribed fire due to the USDI Fish and Wildlife Service's Biological Opinion and Incidental Take Statement for the Threatened and Endangered Species Amendment to the Forest Plan. It is estimated that timber harvest and prescribed fire levels will not exceed the Take Statement annual allowances.

Timber Supply – There are an estimated 253,400 acres of suited timberlands (28 percent of the Forest) in this alternative, and the maximum timber volume to be produced from those acres is estimated at 8.3 MMCF (50 MMBF) per year. Management Prescriptions associated with suited timberlands (3.0, 4.1, 6.1) represent the most likely areas where localized harvest-related activities may occur. Within these MPs, however, are many areas where timber production will not occur on a regulated basis. These areas include roads, waterways, stream channel and wetland buffers, recreation and administrative sites, cultural resource sites, mining sites, some habitats for listed species, extremely steep or rocky areas, and areas that have restricted access.

Backcountry Recreation - Management Prescriptions that emphasize undeveloped recreation (5.0, 5.1, 6.2, 8.1 SPNM) comprise an estimated 46 percent of the Forest. This alternative features the most areas recommended for wilderness study (10.8 percent of the Forest). These areas are Big Draft, Cheat Mountain, Cranberry Expansion, Dry Fork, East Fork Greenbrier, Middle Mountain, Gaudineer, Seneca Creek, Spice Run, Roaring Plains West, and Turkey Mountain. They are managed to maintain their wilderness potential and undeveloped character. Recommended and existing wilderness comprise 19.4 percent of the Forest. Existing Wilderness areas are managed to preserve wilderness values. MP 6.2 areas are managed to maintain wilderness potential in Semi-Primitive Non-Motorized areas, although roads exist in many areas and can be used for administrative access.

Water and Soil – Management Prescriptions that would have low potential for management-related disturbance to soil and water resources (5.0, 5.1, 6.2, 8.1, 8.2, 8.3, 8.4, 8.5) comprise an estimated 46 percent of the Forest. Other lands considered unsuited for commercial timber production (T&E species habitat, stream buffer zones, scenic corridors, etc.) comprise another 25 percent of the Forest. Additional inventory, mitigation, and monitoring may also be applied in areas where management actions have the potential to contribute to soil nutrient depletion related to acid deposition concerns.

Table 2-4 shows acres of MPs by Forest for Alternative 3. See Alternative 3 Map, in the EIS map packet, for MP spatial distribution. Acres are rounded off to the nearest hundred.

Table 2-4. Management Prescription Acres for Alternative 3

Number	Management Prescription	Acres	Percent of Forest
3.0	Age Class Diversity	183,400	20.0
4.1	Spruce and Spruce-Hardwood Restoration	90,100	9.8
5.0	Designated Wilderness	78,700	8.6
5.1	Recommended Wilderness*	99,400	10.9
6.1	Wildlife Habitat Diversity	177,900	19.4
6.2	Backcountry Recreation	225,900	24.7
8.0	Special Areas	60,600	6.6

*Recommendations for Wilderness under any alternative are preliminary administrative recommendations only. Any recommendation would receive further review and possible modification by the Chief of the Forest Service, the Secretary of Agriculture, and the President of the United States. Congress has reserved final decisions to designate Wilderness to the National Wilderness Preservation System.

Alternative 4

Alternative 4 was developed to provide more emphasis on active vegetation restoration. Management Prescriptions 3.0, 4.1, and 6.1 are applied liberally to the landscape to facilitate restoration of spruce, spruce-hardwood, oak-pine, and oak-hickory ecosystems. A full range of recreation experiences is available, and semi-primitive settings and opportunities are abundant, though not as much as in the other alternatives. No areas are recommended for Wilderness study. Many of the areas that have a 6.2 or 5.1 prescription under other alternatives, have a 4.1 or 6.1 prescription in Alternative 4 to allow for more vegetation restoration.

Issues Used to Develop this Alternative

Vegetation Management Issue: Compared to Alternative 2, Alternative 4 reassigns acres from MP 6.2 that features backcountry recreation opportunities to MPs 4.1 and 6.1 that emphasize restoration of spruce-hardwood and oak ecosystems. This alternative provides the most potential for vegetation management of all the alternatives considered in detail.

The Major Issues and the Management Prescriptions

Management Prescriptions are similar to those in Alternative 2 but allocations are different. In terms of land acreage, the major management prescriptions under Alternative 4 are:

- 6.1 – Wildlife Habitat Diversity (33.9 percent),
- 3.0 – Age Class Diversity (22.1 percent),
- 4.1 – Spruce and Spruce Hardwood Restoration (21.8 percent),
- 5.0 – Designated Wilderness (8.6 percent),
- 8.0 – Special Areas (8.0 percent),
- 6.2 – Backcountry Recreation (5.6 percent).

Vegetation Management - Management Prescriptions that emphasize restoration of vegetation conditions (4.1, 6.1) comprise an estimated 56 percent of the Forest. Prescription areas for 6.1 and 3.0 were shifted around somewhat to better reflect the potential for different types of vegetation management. MPs 6.1 and MP 4.1 emphasize restoration of declining or recovering forest communities. Forest-wide direction addresses non-native invasive species and rare plants and communities, with the intent to enhance the diversity and sustainability of forest ecosystems. There is currently an annual allowance of up to 6,000 acres treated by timber harvest and 300 acres treated by prescribed fire due to the USDI Fish and Wildlife Service's Biological Opinion and Incidental Take Statement (March 2002) for the Threatened and Endangered Species Amendment. It is estimated that timber harvest levels will not exceed the annual allowance in the Incidental Take Statement. However, the Forest is proposing to increase the prescribed fire allowance to 7,500 acres to help achieve desired oak ecosystem restoration.

Timber Supply – There are an estimated 346,700 acres of suited timberlands (38 percent of the Forest) in this alternative, and the maximum timber volume to be produced from those acres is estimated at 13.3 MMCF (80 MMBF) per year. Management Prescriptions that have suited timberlands within them (3.0, 4.1, and 6.1) represent the most likely areas where localized harvest-related activities may occur. Within these MPs, however, are many areas where timber production will not occur on a regulated basis. These areas include roads, waterways, stream channel and wetland buffers, recreation and administrative sites, cultural resource sites, mining sites, some habitats for listed species, extremely steep or rocky areas, and areas that have restricted access.

Backcountry Recreation - Management Prescriptions that emphasize undeveloped recreation (6.2, 5.0, 8.1 SPNM) comprise an estimated 17 percent of the Forest. This alternative would recommend no areas on the Forest for Wilderness study. Existing Wildernesses are managed to preserve wilderness values. The 6.2 areas are managed to maintain wilderness potential in roadless areas, although roads exist in many areas and can be used for administrative access.

Water and Soil – Management Prescriptions that would have low potential for management-related disturbance to soil and water resources (5.0, 6.2, 8.1, 8.2, 8.3, 8.4, 8.5) comprise an estimated 17 percent of the Forest. Other lands considered unsuited for commercial timber production (T&E species habitat, stream buffer zones, scenic corridors, etc.) comprise another 43 percent of the Forest. Additional inventorying, mitigation, and monitoring may also be applied in areas where management actions have the potential to contribute to soil nutrient depletion related to acid deposition concerns.

Table 2-5 shows acres of MPs by Forest for Alternative 4. See Alternative 4 Map, in the EIS map packet, for MP spatial distribution. Acres are rounded off to the nearest hundred.

Table 2-5. Management Prescription Acres for Alternative 4

Number	Management Prescription	Acres	Percent of Forest
3.0	Age Class Diversity	202,900	22.1
4.1	Spruce and Spruce-Hardwood Restoration	199,800	21.8
5.0	Designated Wilderness	78,700	8.6
5.1	Recommended Wilderness	0	0
6.1	Wildlife Habitat Emphasis	310,300	33.9
6.2	Backcountry Recreation	51,000	5.6
8.0	Special Areas	73,600	8.0

COMPARISON OF ALTERNATIVES

This section summarizes effects from the alternatives on the issue-related resources, in the same order they are presented in Chapter 3. Please refer to Chapter 3 for a more comprehensive analysis of the potential direct, indirect, and cumulative effects of the alternatives.

Air Quality

Indicators and Effects - Potential missions of particulate matter (PM) and nitrogen oxide (NOx) from predicted timber harvest and prescribed fire activities were evaluated in comparison to total PM and NOx emissions in counties near the Forest. These results are in Table 2-6.

Table 2-6. Cumulative Emission Estimates for Management Activities on the MNF

Alternative	Pollutant	MNF Total Management Emissions (Tons per Year)	Total Regional Emissions (Tons per year)	Percent MNF Management Activities of Total Regional Emissions
Alternative 1	VOC	110.8	118,251	0.09%
	NO_x	91.2	212,477	0.04%
	PM	47.2	161,925	0.03%
Alternative 2	VOC	110.2	118,251	0.09%
	NO_x	141.1	212,477	0.07%
	PM	425.1	161,925	0.26%
Alternative 2 Modified	VOC	109.7	118,251	0.09%
	NO_x	83.7	212,477	0.04%
	PM	5.0	161,925	0.00%
Alternative 3	VOC	87.4	118,251	0.07%
	NO_x	72.2	212,477	0.03%
	PM	46.1	161,925	0.03%
Alternative 4	VOC	115.2	118,251	0.10%
	NO_x	229.8	212,477	0.11%
	PM	1,055.3	161,925	0.65%

Given that both prescribed fire and timber harvest emissions comprise such a small percentage of the regional pollution load, and the cumulative effects of these Forest management emissions are well below the 5 percent emissions threshold, the effects of these activities on air quality and regional haze should be minimal and should not violate National Ambient Air Quality Standards.

Soil Resource

Acres of potential timber harvest in suited MPs by alternative - Timber harvest numbers in Table 2-7 are estimates from the Spectrum model of maximum activity that could occur given certain management constraints. Acres are annual averages for the next two decades.

Table 2-7. Maximum Potential Timber Harvest Acres by Alternative

Activity	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Maximum Potential Acres – Conventional Yarding	3,445	2,853	2,826	2,638	3,498
Maximum Potential Acres – Helicopter Yarding	2,296	1,902	1,884	1,759	2,332
Maximum Total Acres Treated	5,741	4,755	4,710	4,397	5,830

Alternative 3 would have the least amount of timber harvest over the next two decades, followed in ascending order by Alternatives 2M, 2, 1, and 4. The risk for soil productivity losses would also be the least for Alternative 3, followed in ascending order by Alternatives 2M, 2, 1, and 4, based on both total harvest acres and conventional methods used to harvest those acres. The range of management direction and mitigation provided by the Forest Plan should be more than adequate to address soil resource concerns at the project level. Also, a well-defined monitoring plan of implementation would track and verify predicted effects, and allow specialists to adjust input and mitigation needs for future projects.

Percent of high-risk acid-sensitive soils by MP by alternative - Forty-one percent of the total acreage on the Forest is considered to be of high risk to acid deposition. Table 2-8 shows the distribution of those high-risk acres by Management Prescription for each alternative.

Table 2-8. Percent of High-Risk Acid Sensitive Geology Acres by Management Prescription

Alternative	Percent of High Acid Sensitivity Geology within Management Prescriptions										
	2.0	3.0	4.0	4.1	5.0	5.1	6.1	6.2	6.3	7.0	8.0
1	91%	38%	91%	0	61%	0	34%	41%	32%	78%	52%
2	0	35%	0	65%	61%	79%	31%	38%	0	0	33%
2M	0	36%	0	55%	61%	79%	32%	38%	0	0	34%
3	0	31%	0	51%	61%	41%	28%	48%	0	0	38%
4	0	36%	0	53%	61%	0	32%	48%	0	0	33%

For all alternatives, the areas on the Forest with the highest sensitivity to acid deposition and potential nutrient loss tend to fall in those MPs where little or no regulated timber harvest or road construction would occur. MPs 5.0, 5.1, 6.2, and large portions of MPs 4.1 and 8.0 would provide widespread protection related to the effects of acid deposition by greatly reducing the potential for soil disturbance and removal of soil nutrients. Conversely, the areas on the Forest with the lowest sensitivity to acid deposition and potential nutrient loss tend to fall in those MPs (3.0, 6.1) where regulated timber harvest or road construction could occur. The relatively low percentages of high sensitivity areas mean that there should be a relatively high percentage of land available for management without potentially affecting soils that are highly sensitive to acid deposition and nutrient loss.

Watershed, Riparian, and Aquatic Resources

Suitable timber lands by alternative – Management Prescriptions that permit a greater level of timber harvest and associated road building are considered to have a greater potential to disturb water, riparian and aquatic conditions than those that limit timber harvest. Not all of the acres located within the MPs are suited or available for timber harvest. Table 2-9 displays the suited timber lands by alternative.

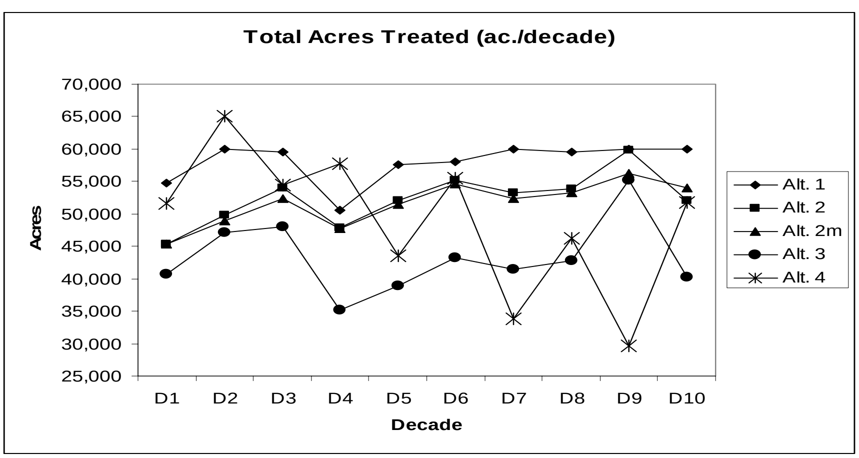
Table 2-9. Lands Suited and Available for Commercial Timber Harvest

Indicator	Acres and Percent by Alternative				
	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Acres of Suitable Timber Lands	332,200	330,300	329,400	253,400	346,700
Percent of Forest Land Base	36%	36%	36%	28%	38%

In the Chapter 3 analysis, these acres are broken out by 31 fifth-level watersheds on the Forest. Alternative 3 has the lowest, or tied for lowest, potential impact in 19 of the 31 watersheds. Alternative 1 is next with 11 watersheds, and Alternative 2M, Alternative 2 and Alternative 4 follow in order, as they have the lowest level in 10, 9 and 8 watersheds respectively.

Acres, volume, and logging methods of potential timber harvest by alternative - Figure 2-1 displays the long-term trends in maximum potential acres harvested on suited timber lands by alternative.

Figure 2-1. Maximum Acres Potentially Harvested by Alternative per Decade

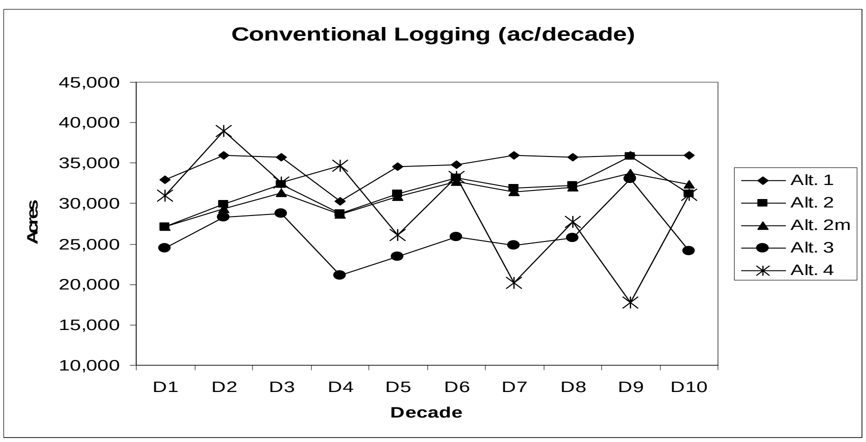


Alternative 3 has the lowest estimated harvest activity in the first decade (40,764 ac.), followed by Alternatives 2 (45,297 ac.), 2M (45,338 ac.), 4 (51,573 ac.), and 1 (54,821 ac.). In subsequent decades, the potential level of activity shifts between alternatives. Alternative 3 maintains the lowest or second lowest level of potential treatment through all decades, while Alternative 1 remains the highest or second highest level through all decades. Alternative 4 has the broadest range with a high level of 65,000 acres in Decade 2 and a low level of 29,600 acres in Decade 9.

Harvest volume by alternative - Another way to look at potential effects from timber harvest is the allowable sale quantity (ASQ), which is a measure of the potential volume of timber harvested, reported as million board feet per year (MMBF/year). Alternative 3 has the lowest ASQ in the first decade and most of the subsequent decades. The ASQ for Alternative 3 remains at 50 MMBF through all decades. For the life of the plan, Alternative 4 has the highest ASQ at 80 MMBF and it remains at that level for the first four decades before dropping off. Alternatives 2, 2M, and 1 remain constant through the decades at 63, 63, and 65 MMBF, respectively. All of this volume is expected to come from lands outside of stream channel and wetland buffer zones, where shade and large woody debris needs would be met by management direction.

Logging methods by alternative - Vegetation modeling assumed that 60 percent of the total acres to be treated would be conventionally logged and 40 percent helicopter logged. Figure 2-2 displays the projected acres of conventional logging by alternative. Alternative 3 has the lowest level of conventional logging during the life of the plan, followed by Alternatives 2, 2M, 4 and 1.

Figure 2-2. Maximum Potential Acres Conventionally Logged by Alternative by Decade



We also modeled the proximity of potential harvest activities to the existing road system. Table 2-10 displays the projected level of conventional harvest for each alternative in Decade 1, and the proximity to existing roads.

Table 2-10. Potential Conventional Timber Harvest Acres by Alternative in Decade 1
(Figures represent maximum potential acres for the first 10-year period)

Activity	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Conventional Harvest Acres	32,893	27,178	27,203	24,458	30,944
Distance to Road: 0/0 to 3/8 mi.	24,219	25,649	25,142	22,848	25,886
Distance to Road: 3/8 to 6/8 mi.	6,529	1,425	2,061	1,057	4,270
Distance to Road: 6/8 to 9/8 mi.	1,045	80	0	553	500
Distance to Road: 9/8 mi. +	1,100	24	0	0	288
Total Distance Greater than 3/8 mile	8,674	1,529	2,061	1,610	5,028

The assumption is that acres within 3/8 mile of an existing road may be conventionally harvested without the need for road access that could result in additional road-related ground disturbance. If the distance is over 3/8 mile, new roads may be needed to access the units. Alternative 2 has the fewest overall acres that would need road access, followed by Alternatives 3, 2M, 4, and 1.

Summary - Implementation of Forest-wide standards and guidelines would minimize the potential direct, indirect, and cumulative effects of land management activities on NFS lands. Alternative 3 has the lowest potential for ground-disturbing activities associated with timber harvest activities, followed by Alternatives 2 and 2M, 4, and then 1.

Terrestrial Ecosystem Diversity

Amount and development stages of major forested communities by alternative – Potential changes to development stages by forested community would follow similar patterns under all alternatives, although the amounts differ somewhat by alternative. The patterns and amounts are similar because: 1) development stages across all forested communities are currently dominated by mature stands, with relatively few young or old stands, and 2) over 60 percent of the Forest would receive little or no harvest treatments under any alternative, resulting in the aging of mature stands into old forest stands. Thus, the patterns or trends under all alternatives are:

- Old forest stands will increase,
- Mature forest stands will decrease,
- Young forest stands will increase where active management occurs, and
- Mature forest will recover somewhat over time as managed young stands grow older, but they will likely never achieve the amount and distribution they have currently.

The more even-aged regeneration harvest occurs, the more young development stage would be created. Alternative 4 would generally have the most even-aged regeneration harvest during the early decades of the planning horizon, and Alternative 1 would generally have more thereafter. Alternative 3 would have the least regeneration harvest and therefore the most old forest over time. Alternatives 2 and 2M would have amounts similar to but slightly less than Alternative 1.

Amount of each rare and unique community by alternative - Amounts of most rare and unique communities are not expected to change substantially from current amounts regardless of alternative (see Table 2-11).

Table 2-11. Projected Amounts of Rare and Unique Communities in Future Decades Compared to Estimated Presettlement, 1935, and Current Amounts
(NFS land only. All amounts are acres unless otherwise noted. Amounts in bold are within the estimated presettlement range or within +/- 5 percent of the estimated presettlement amount.)

Community	Presettle-ment	1935	Current	Alt. 1	Alt. 2	Alt 2M	Alt. 3	Alt. 4
Bogs, fens, seeps, seasonal ponds	Unknown	Unknown	2,000	2,000	2,000	2,000	2,000	2,000
Open wetlands	Unknown	Unknown	1,000	1,000	1,000	1,000	1,000	1,000
Stream channels (miles)	3,000	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**
Glades and barrens	2,000	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**
Rock outcrops and cliffs	6,000	**6,000**	**6,000**	**6,000**	**6,000**	**6,000**	**6,000**	**6,000**
High-elevation grasslands	Unknown	22,000	14,000	17,000	16,000	16,000	13,000	18,000
Shrub balds	Unknown	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Caves/mines (entrances)	225	**225**	**225**	**225**	**225**	**225**	**225**	**225**
Woodlands, savannas, and grasslands	Unknown	40,000	7,000	15,000	14,000	14,000	10,000	15,000
Lakes and ponds	Unknown	Unknown	200	200	200	200	200	200
Total remote habitat	915,000	Unknown	190,000	200,000	220,000	240,000	410,000	150,000

Three communities occur on a larger scale and could change in area because of Forest Service management: high-elevation grasslands; woodlands, savannas, and grasslands; and remote habitat. Relative to the current amount, the amount of high-elevation grassland is projected to increase somewhat under all alternatives except Alternative 3, where it would decrease slightly. Woodlands, savannas, and grasslands are projected to approximately double under Alternatives 1, 2, 2M, and 4; it is projected to increase a little more than 40 percent under Alternative 3. These are considered maximum potential increases assuming desired conditions for maintained openings will be met.

Remote habitat would be most extensive under Alternative 3, increasing from the current estimated 190,000 acres to 440,000 acres. In contrast, remote habitat under Alternative 4 would decrease to an estimated 170,000 acres. Under Alternatives 1, 2, and 2M, remote habitat would increase by moderate amounts, to about 200,000, 220,000 and 240,000 acres, respectively.

Representation of ecological communities in Minimum Dynamic Area (MDA) reserves - The total amount of land contained in MDA reserves is highest in Alternative 3, which has 520,000 acres, or 57 percent of NFS land, in reserves (Table 2-12). Total land in MDA reserves is lowest in Alternative 1 at 310,000 acres, or 34 percent of NFS land. Alternative 2 has 380,000 acres (42 percent of NFS land), Alternative 2M has 390,000 acres (43 percent of NFS land), and Alternative 4 has 360,000 acres (39 percent of NFS land) in reserves. Table 2-13 shows the percentages of forested communities within MDA reserves by alternative. Percentages would increase under all alternatives, with the most increases occurring under Alternative 3.

Table 2-12. Minimum Dynamic Area Reserves by Alternative

Indicator	Alternative 1 Existing Condition	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Number of MDA reserves	10	10	10	14	9
Total acres in MDA reserves	310,000	380,000	390,000	520,000	360,000
Percent of all NFS Land in MDA reserves	34%	42%	43%	57%	39%
Percent of all Land in Forest Boundary in MDA reserves	18%	23%	23%	30%	21%

Table 2-13. Percent of Major Forested Communities within MDA Reserves[1]

Community	Percent of Current Community Amount on NFS Lands in MDA Reserves				
	Alt. 1 - Current Condition	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Spruce forest	95	97	97	97	97
Mixed mesophytic/cove forest	29	36	36	47	33
Northern hardwood forest	71	81	81	84	81
Hemlock forest	56	63	63	83	62
Oak forest	9	16	16	42	12
Pine-oak forest	12	22	22	64	16

[1]MDAs are blocks 10,000 acres or larger where even-aged management is prohibited or greatly limited.

Terrestrial Species Viability

Distribution of viability outcomes by alternative - As a measure of the aggregate level of risk to species viability, the numbers of A, B, C, D, and E viability outcomes were compared across the alternatives. Projected viability outcomes under the alternatives showed little change from current conditions (Table 2-14). Each of the alternatives had 188 species with viability outcomes of C, D, or E, indicating low abundance and some degree of risk to viability. This is a net decrease of one species from the 189 species with C, D, or E outcomes under existing conditions. Considering just the higher-risk D and E outcomes, Alternatives 1 and 3 each had 128 species with these outcomes, whereas Alternatives 2, 2M, and 4 each had 127 species. These results show a slight projected improvement from the 129 species that currently have D or E outcomes. Compared to current conditions, Alternatives 1 and 3 each had three species with decreased risk to viability and one species with increased risk to viability, while Alternatives 2, 2M, and 4 each had four species with decreased risk and one species with increased risk. Table 2-15 shows the species outcomes that differed from current conditions.

Table 2-14. Viability Outcomes by Alternative and Comparison to Current Outcomes

Outcome	Number of Species With the Specified Outcome					
	Current	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
A	3	3	3	3	3	3
B	17	18	18	18	18	18
C	60	60	61	61	60	61
D	71	71	70	70	71	70
E	58	57	57	57	57	57
Insufficient Information	10	10	10	10	10	10
Number of species with decreased risk relative to current	--	3	4	4	3	4
Number of species with increased risk relative to current	--	1	1	1	1	1

Table 2-15. Species with Projected Viability Outcomes that Differed from Current Conditions

Species	Viability Outcome					
	Current Condition	Alt.1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Birds						
Black-billed cuckoo	C	B	B	B	B	B
Yellow-breasted chat	C	B	B	B	B	B
Red-headed woodpecker	D	D	C	C	D	C
Mourning warbler	B	C	C	C	C	C
Invertebrates						
Diana fritillary[1]	E	C	C	C	C	C

[1]Regional Forester's Sensitive Species.

Effect determinations for Regional Forester's Sensitive Species by alternative - Currently there are 84 terrestrial species that are listed as RFSS on the Forest. Table 2-16 summarizes their viability outcomes by alternative for RFSS.

Table 2-16. Summary of Viability Outcomes for RFSS

Viability Outcome	Number of RFSS With Outcome Shown					
	Existing Condition	Alternative 1	Alternative 2	Alternative 2M	Alternative 3	Alternative 4
A	0	0	0	0	0	0
B	2	2	2	2	2	2
C	13	14	14	14	14	14
D	26	26	26	26	26	26
E	41	40	40	40	40	40
Insufficient Information	1	1	1	1	1	1

Viability outcomes for RFSS showed no differences among alternatives, and only one RFSS had a viability outcome that differed from the current conditions. The outcome for this species, Diana fritillary, improved from E under the existing condition to C under all alternatives. For all RFSS, we have determined that each alternative may impact individuals, but is not likely to cause a trend toward federal listing or a loss of viability.

Terrestrial Management Indicator Species and Other Species of Interest

Indicators and Effects

Optimum habitat for cerulean warbler (MIS) – area of mid-late and late successional (80+ years old) mixed mesophytic and cove forests. Projected optimum habitat for cerulean warbler for the next 100-years follows a similar pattern under all alternatives, with minor differences in the amount in certain decades. In the first decade, optimum cerulean warbler habitat is projected to drop from the current estimated 200,000 acres to around 175,000 to 180,000 acres under all alternatives. This small decline is due to projected timber harvesting in 80+ year-old mixed mesophytic stands. The decline is projected to be short-lived, however, followed by a large increase to about 290,000 to 300,000 acres in the second decade under all alternatives. This increase is due to the large acreage of current mid-successional mixed mesophytic stands reaching 80+ years old in the second decade. Following this increase, a gradual decline is projected through the seventh decade for all alternatives as harvesting to achieve age class diversity removes some mid-late and late successional stands. The amount is projected to rise gradually under all alternatives in the eighth through tenth decades, with the differences among alternatives becoming smaller and all alternatives finishing between 250,000 and 270,000 acres. In every decade of the planning horizon, the amount of optimum habitat produced by each alternative exceeds at least 3.5 times the 50,000-acre cerulean warbler habitat objective set by Partners in Flight for the entire mid-Atlantic Ridge and Valley physiographic area (Partners in Flight 2003). Therefore, all alternatives should provide ample habitat for cerulean warblers.

Optimum habitat for wild turkey (MIS) – area of oak and pine-oak forest of optimum mast-producing age (50-150 years old), plus openings, within MPs 2.0, 3.0, 6.1, and 6.3. Due to aging and harvesting of oak and pine-oak stands that currently are in the optimum mast-producing range, optimum turkey habitat will decline throughout the planning horizon under all alternatives. Because this indicator considers only those optimum mast-producing stands and openings that are in MPs 2.0, 3.0, and 6.1, the decline will be most pronounced under Alternative 3, which allocates large areas that currently are MP 6.1 to MPs 5.1 and 6.2. Through the fifth decade of the planning horizon, the decline would be gradual, as timber harvesting to achieve age class diversity removes some 50- to 150-year-old oak and pine-oak stands. In the fifth decade, Alternative 1 would provide the most optimum turkey habitat, at about 215,000 acres, while Alternative 3 would provide the least, at about 125,000 acres. Alternatives 2, 2M, and 4 would each produce about 185,000 acres. The projected decline becomes much steeper in the sixth and seventh decades as many stands that are currently in the optimum mast-producing range age beyond 150 years. The projected decline levels off in the eighth through tenth decades as stands harvested in the early decades reach the optimum mast-producing range. Because Alternative 4 has the highest harvest levels in the early decades, it has the highest amount of projected optimum turkey habitat in the eighth through tenth decades. In the tenth decade, Alternative 4 would provide a little more than 110,000 acres. Alternative 3 still is projected to have the lowest amount of optimum turkey habitat; it would provide a little over 60,000 acres in the tenth decade. Alternatives 1 and 2 would provide 85,000 to 90,000 acres. Most of the future decline in optimum turkey habitat is due to the current concentrated age class distribution of the Forest. The current concentration of nearly all oak and pine-oak stands in the optimum mast-producing age range is not sustainable over the long term under any possible management scenario. Because of the inevitable decline in optimum habitat, the Forest's carrying capacity for turkeys is expected to decline under all alternatives, particularly in the later decades of the planning horizon. The decline would be more pronounced under Alternative 3 than the other alternatives, especially during the first half of the planning horizon.

Optimum habitat for West Virginia northern flying squirrel (MIS) (area of mid-late and late successional spruce forest) and Potential Active Spruce Restoration Areas (roughly the area of mid-late and late successional northern hardwoods in MP 4.1, outside of current suitable flying squirrel habitat). Optimum habitat for West Virginia northern flying squirrel is projected to increase substantially under all alternatives. By the second decade of the planning horizon, optimum habitat would increase from the current 23,000 acres to about 42,000 acres, regardless of alternative. After 20 years the great majority of it will have reached the optimum mid-late and late successional stages. After the first two decades, a continued gradual increase is projected, with the amount reaching about 48,000 acres under all alternatives in the eighth through tenth decades. Potential active spruce restoration areas are projected to increase gradually under the action alternatives in the early decades of the planning horizon. Alternative 1, which does not include MP 4.1, does not provide any potential active spruce restoration areas as measured by this indicator. Although patterns are the same, the amounts differ among the action alternatives. Alternative 4 would provide the most potential active spruce restoration area, with the amount leveling off at about 34,000 acres in the fifth through tenth decades. Alternative 3 would provide the least, with a little less than 10,000 acres in the fifth through tenth decades. Alternatives 2 and 2M would provide about 23,000 acres in the fifth through tenth decades.

Edge habitats providing abundant browse for white-tailed deer – all early successional forest (0-19 years old) plus openings. Edge habitats providing abundant browse for white-tailed deer are projected to increase sharply in the first and second decades of the planning horizon as harvesting to achieve age class diversity begins. The increase would be greatest under Alternative 4, with the amount reaching nearly 120,000 acres by the second decade. The increase would be smallest under Alternative 3, with the second-decade amount reaching about 83,000 acres. Amounts under Alternatives 1, 2, and 2M would reach around 100,000 acres in the second decade. In the third decade, the amount under Alternative 4 would decline somewhat and the amounts under Alternatives 1, 2, 2M, and 4 would be similar. For the third through seventh decades, the amount under these alternatives would fluctuate between 100,000 and 110,000 acres. Under Alternative 3, this indicator would fluctuate between about 80,000 and 90,000 acres during the entire planning horizon.

Optimum habitat for black bear – 50 to 150-year-old oak and pine-oak forest in MPs with limited public motorized access (MPs 4.1, 5.0, 5.1, 6.1, 6.2, 6.3, and remote backcountry portions of the NRA). Due to aging and harvesting of oak and pine-oak stands that currently are in the optimum mast-producing age range, optimum habitat for black bear would decline throughout the planning horizon under all alternatives. For the first six decades, the decline would be gradual and would be due primarily to harvesting of stands that are in the optimum mast-producing age range. During this time, Alternative 4 would produce the least optimum bear habitat, primarily because of lower land allocations to remote MPs, but also because of higher harvesting levels. The differences among alternatives would be greatest in the fifth decade, when Alternative 4 would provide just over 140,000 acres of optimum bear habitat, while Alternatives 1 and 3 would provide over 180,000 acres. In the seventh decade, optimum bear habitat would decrease substantially regardless of alternative, with all alternatives producing 70,000 to 75,000 acres. This large decrease is due to aging of oak and pine-oak forest beyond the optimum mast-producing age range. In the remaining decades of the planning horizon, Alternative 4 would provide somewhat more optimum bear habitat than the other alternatives. This is because the higher level of harvesting early in the planning horizon under Alternative 4 would produce more acreage to mature into the optimum mast-producing age range during the later decades of the planning horizon.

Threatened and Endangered Species

Running buffalo clover (RBC): potential effects to young and old successional stages of mixed mesophytic forest. Table 2-17 displays the approximate acres of potential habitat by management prescription at the start of the planning period all alternatives. Since potential habitat is based on successional stages, over time some areas will move into or out of potential habitat due to either management actions or no action.

Table 2-17. Acres of Potential RBC Habitat by Management Prescription by Alternative

Management Prescriptions	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
MP 5.0, 5.1, 6.2 – Little or no vegetation management	2,600	3,000	3,000	8,000	2,700
MP 4.1, 6.3, 7.0, 8.0 – Low levels of vegetation management	9,700	8,600	8,600	6,900	8,800
MP 2.0, 3.0, 4.0, 6.1 – Active vegetation management	19,900	22,800	22,800	19,400	22,900

Timber harvest activities, road construction and reconstruction, and road decommissioning (when it requires earth-moving activities) all have potential to effect RBC. Alternatives 2, 2M, and 4 have the greatest chance of impacting RBC and its habitat directly through disturbance. However, considering RBC needs a low level of disturbance to compete with other species, the effects of active management may be positive as well.

Shale barren rock cress (SBRC): potential effects to shale barrens by alternative. Potential habitat for SBRC is defined as shale barren areas with surface rock. Potential and known habitat on the Forest is estimated to be less than 100 acres. Known sites are protected by either assignment to an 8.0 management prescription or as protected inclusions in other prescriptions. Populations are monitored, and management of the habitat is coordinated with the WVDNR Heritage Program staff. Therefore, there would likely be no measurable direct or indirect effects to SBRC as a result of implementing any of the alternatives.

Small whorled pogonia (SWP): potential effects to hemlock forest and old plus mature mixed mesophytic forest. Potential habitat for SWP is defined as old and mature mixed mesophytic hardwood forests, old and mature oak, and old and mature pine-oak forests. Table 2-18 shows the acres of this potential habitat by MP for all alternatives at the start of the planning period. Since potential habitat is based on successional stages, over time some areas will move into or out of potential habitat due to management action or no action.

Table 2-18. Acres of Potential SWP Habitat all Alternatives and All Management Prescriptions

Community Type	Current Acres
Mixed mesophytic hardwoods(old and mature)	329,100
Oak (old and mature)	229,600
Pine-oak (old and mature)	44,500
Total	**603,200**

Under all alternatives, the majority of the area considered potential habitat is found in areas with MPs allowing active forest management. In these areas, direct and indirect effects to SWP would be avoided through surveys made before action is taken. Since this species is so rare and is known to remain dormant in some years, it could be missed in surveys of areas proposed for active management. The largest potential for this to occur is in MP 3.0 or 6.1 areas. Direct effects possible if the plant is missed include destruction of habitat or loss of individuals. The potential is slightly lower in Alternative 3 than in Alternatives 1, 2, 2M, or 4.

Virginia spiraea: potential effects to the banks of low-elevation large streams by alternative. This habitat is estimated to be only about 18,000 acres across the Forest, and Virginia spiraea is restricted to riparian areas. Riparian area protection for Forest-wide shade strips for Alternative 1, and for revised Forest-wide Soil and Water direction for Alternatives 2-4, would be applied site-specifically at the project level, and would greatly reduce the potential for impacts to Virginia spiraea along streams and rivers. As with other T&E species, surveys would be made before management occurs. Timber harvest does not generally occur in the riparian areas of larger streams and rivers. Therefore, there would likely be no measurable direct or indirect effects to Virginia spiraea as a result of implementing any of the alternatives.

Virginia big-eared Bat (VBEB): potential effects to foraging area by alternative. All alternatives would adequately protect VBEB populations and habitat through the application of management direction found in the 1986 Plan as amended or the 2006 Forest Plan, and through the consultation process with USFWS that would occur for any Forest project that has the potential to affect this species or its habitat. Thus, the analysis presented below represents the relative capability of the alternatives to potentially enhance or maintain current foraging habitat for VBEB through prescribed fire. Prescribed fire within VBEB foraging circles could have beneficial effects on foraging habitat by encouraging an herbaceous understory. Potential prescribed fire acres would differ by alternative as seen in Table 2-19.

Alternatives 1 and 3 would have little potential to improve VBEB foraging habitat using fire, whereas Alternative 4 would increase prescribed fire in VBEB habitat to more than 20 times the currently allowed level. Alternatives 2 and 2M would increase prescribed fire in VBEB habitat substantially beyond current levels, but would still be far below the levels of Alternative 4.

Table 2-19. Projected Acres of Prescribed Fire in Virginia Big-Eared Bat Foraging Habitat During the First Decade of the Planning Horizon

Indicator	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Total VBEB Foraging Circle Acres on NFS Land	324,000	324,000	324,000	324,000	324,000
FRCC I, 3 and FRCC III, 2 Acres in MPs 3.0, 6.1, 6.3, 8.1, in VBEB Circles	62,000	69,000	67,000	63,000	69,000
Maximum Projected Acres of Prescribed Fire Treatment in VBEB Circles During the First Decade	1,000	10,000	10,000	1,500	24,000

Indiana bat: potential effects to hibernacula, key area, maternity site, and primary range by alternative. It is expected that all of the alternatives would adequately protect Indiana bat populations and habitat through the application of management direction found in the 1986 Plan as amended or the revised Forest Plan, and through the consultation process with USFWS that would occur for any Forest project that has the potential to affect this species or its habitat. The analysis presented below represents the relative capability of the alternatives to potentially maintain current habitat through no action, or to enhance habitat through management.

Within Indiana bat primary range, prescribed fire could be used to create and maintain semi-open stand structure that is favorable for roosting and foraging. Estimates of potential improvement to Indiana bat habitat within 5 miles of hibernacula through prescribed fire are based on Forest-wide goals and objectives in the 2006 Forest Plan (see Table 2-20).

Table 2-20. Projected Acres of Prescribed Fire in Indiana Bat Primary Range During the First Decade of the Planning Horizon

Indicator	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Total Acres of Indiana Bat Primary Range on NFS Land	228,000	228,000	228,000	228,000	228,000
FRCC I, 3 and FRCC III, 2 Acres in MPs 3.0, 6.1, 6.3, 8.1, in Primary Range	48,000	50,000	50,000	43,000	51,000
Maximum Projected Acres of Prescribed Fire Treatment in Primary Range During the First Decade	800	7,600	7,600	1,000	18,000

Alternatives 1 and 3 would have little potential to improve primary range using prescribed fire, whereas Alternative 4 would increase prescribed fire in primary range to more than 20 times the currently allowed level. Alternatives 2 and 2M would increase prescribed fire in primary range substantially beyond current levels, but would still be far below the levels of Alternative 4. Although specific objectives for prescribed fire have not been formulated beyond the first decade of the planning horizon, similar amounts of prescribed fire are expected in subsequent decades.

The expected amount of harvesting for habitat enhancement in primary range was estimated based on Plan objectives for the first decade of the planning horizon (see Table 2-21). Only

Alternative 2M has an explicit objective for Indiana bat habitat enhancement; however, similar habitat enhancement would be desirable under all alternatives. Habitat enhancement for the other alternatives was estimated by proportionally extrapolating the Alternative 2M objective to the areas of primary range that would be available for enhancement based on MP allocations and tentative timber suitability. During the first decade of the planning horizon, Alternatives 1, 2, 2M, and 4 would have similar amounts of habitat enhancement in primary range. The amount would be lower in Alternative 3 because of larger land allocations to MPs where silvicultural habitat treatments would be unlikely.

Table 2-21. Projected Acres of Silvicultural Habitat Enhancement in Indiana Bat Primary Range During the First Decade by Alternative

Indicator	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Total Acres of Indiana Bat Primary Range on NFS Land	228,000	228,000	228,000	228,000	228,000
Acres of Primary Range Where Silvicultural Habitat Enhancement would be Allowed	89,000	86,000	85,000	67,000	94,000
Maximum Projected Acres of Silvicultural Habitat Enhancement in Primary Range	7,300	7,100	7,000	5,500	7,700

West Virginia northern flying squirrel (WVNFS): potential effects to suitable habitat by alternative. It is expected that all of the alternatives would adequately protect WVNFS populations and habitat through the assignment of management prescriptions and the application of management direction found in the 1986 Plan as amended or the 2006 Plan, and through the consultation process with USFWS that would occur for any Forest project that has the potential to affect this species or its habitat. See also the effects summary for this species under Management Indicator Species.

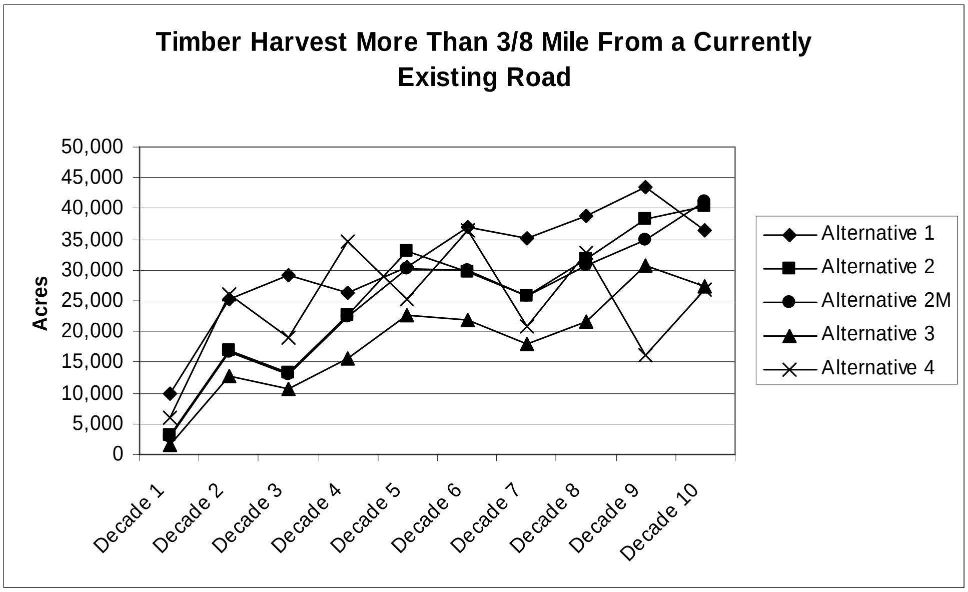
Cheat Mountain salamander: potential effects to Cheat Mountain salamander habitat by alternative. It is expected that all of the alternatives would adequately protect Cheat Mountain salamander populations and habitat through the application of management direction found in the 1986 Plan as amended or the 2006 Plan, and through the consultation process with USFWS that would occur for any Forest project that has the potential to affect this species or its habitat.

Bald eagle: potential effects to nesting habitat in riparian areas by alternative. Bald eagles may be found mainly along lakes or lower-elevation reaches of large rivers. Riparian area protection measures identified under the 1986 Plan for Alternative 1, and under 2006 Plan Forest-wide direction for Alternatives 2-4, would be applied site-specifically at the project level, and would greatly reduce the potential for impacts to bald eagles and their habitats along streams and rivers. Therefore, there would likely be no measurable effects to bald eagles as a result of implementing any of the alternatives.

Non-native Invasive Species

Amount of timber harvest 3/8 of a mile or more from existing roads by alternative – Roads and road traffic are a known vector for NNIS establishment and spread. Generally, harvest units that are over 3/8 of a mile require construction of new system or temporary roads. Acreage of timber harvest 3/8 of a mile or more from the nearest road was projected by Spectrum modeling and is shown in Figure 2-3.

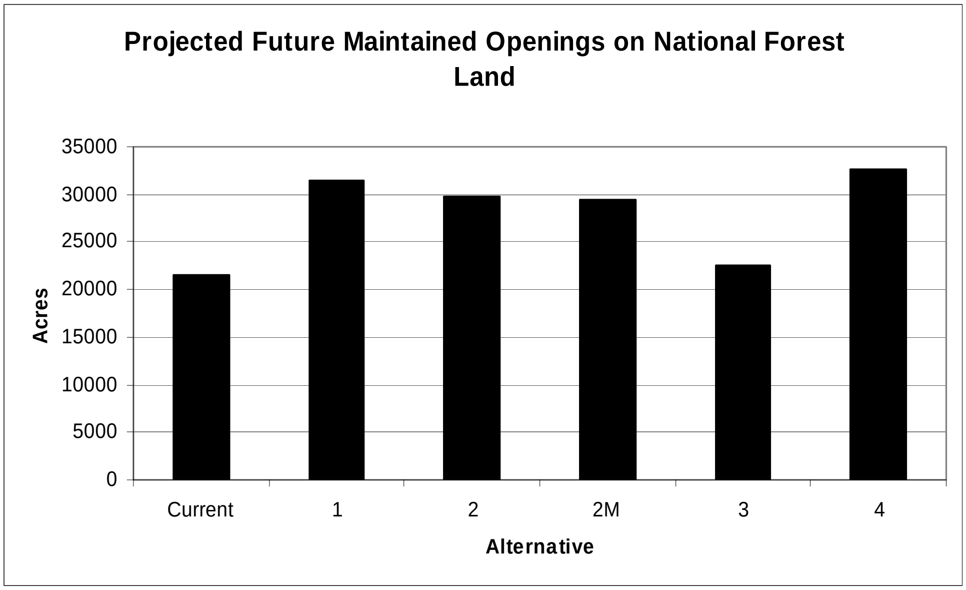
Figure 2-3.



Alternative 1 has the highest amount of projected timber harvest more than 3/8 of a mile from an existing road in most decades, peaking at about 44,000 acres in the ninth decade. Alternative 3 has the lowest amount in most decades, with a peak of about 31,000 acres in the ninth decade. Under Alternatives 2 and 2M, the amount reaches its highest point of about 40,000 acres in the tenth decade, whereas Alternative 4 peaks at about 37,000 acres in the sixth decade. When the indicator is summed across the 10-decade planning horizon, Alternative 1 has a little more than 310,000 acres harvested beyond 3/8 of a mile from a currently existing road, which is the most of any alternative. Alternative 3 has the least, estimated at just over 180,000 acres. Alternatives 2, 2M, and 4 are intermediate at around 250,000 acres. According to this indicator, Alternative 1 would have the highest risk of facilitating the invasion and spread of NNIS plants, Alternatives 2, 2M, and 4 would have intermediate risk, and Alternative 3 would have the lowest risk.

Amount of maintained openings by alternative - The projected future amount of maintained openings differs across alternatives approximately in proportion to allocation of land to the suitable base MPs that have goals for creating and maintaining openings (Figure 2-4). Alternatives 1, 2, 2M, and 4 all have 30,000 to 33,000 acres of maintained openings, whereas Alternative 3 has about 23,000 acres. The projected future amounts under Alternatives 1, 2, 2M, and 4 all represent a noticeable increase from the current estimate of 22,000 acres. Based on this indicator, Alternatives 1, 2, 2M, and 4 would have a higher risk of facilitating invasion and spread of NNIS plants than Alternative 3.

Figure 2-4.



Vegetation Management

Indicators and Effects for Issue #1

Age Class Distribution by Alternative - Tables 2-21 through 2-25 show the age class distributions (in percent) predicted as a result of vegetation management in MPs 3.0 and 6.1 by alternative at the end of the first, fifth, and tenth decades of management.

Alternative 1 **–** MPs 2.0, 3.0, 4.0, and 6.1 contain an estimated 332,200 acres of MNF lands that can be actively managed for timber in this alternative. On the remaining 585,200 acres, only natural disturbance events would contribute to creating early successional habitat. One major constraint that restricts regeneration harvests on suitable timber lands is the 200-year rotation cycle for most forest types. This averages to ½ percent per year of regeneration harvest to attain a balanced age class distribution on those acres that can be actively managed. On 332,200 acres it would be necessary to annually regenerate an average of 1,661 acres to balance age classes over the 200-year rotation cycle. If this alternative were to achieve desired conditions in the revised Forest Plan in a 10-decade time frame, it is estimated that annually 4,200 acres have to be regenerated into early successional stands, or about 0.5 percent of the total MNF acres.

Table 2-21. Age Class Distribution Percentages in MPs 3.0 and 6.1 for Alternative 1

Time Frame	Percent of Age Class or Successional Stage – MP 3.0				
	Early (0-19 years)	Early to Mid (20-39 years)	Mid (40-79 years)	Mid to Late (80-119 years)	Late (≥120 years)
Current Distribution	4.6	4.8	31.1	54.1	5.4
End of 1st Decade	5.9	4.8	31.1	52.7	5.5
End of 5th Decade	15.4	17.1	10.7	19.2	37.6
End of 10th Decade	9.4	12.7	19.4	17.9	40.6
Time Frame	**Percent of Age Class or Successional Stage – MP 6.1**				
	Early (0-19 years)	**Early to Mid (20-39 years)**	**Mid (40-79 years)**	**Mid to Late (80-119 years)**	**Late (≥120 years)**
Current Distribution	3.8	4.8	32.2	54.6	4.6
End of 1st Decade	9.6	4.8	32.2	48.8	4.6
End of 5th Decade	14.7	12.8	14.4	21.0	37.1
End of 10th Decade	14.9	13.2	18.7	16.1	37.1

Alternative 2 – An estimated 330,300 acres are available for active management in this alternative. Annually, an estimated maximum of 3,400 acres would be regenerated into early successional stands, or about 0.4 percent of the total MNF acres. Another way of interpreting this is, on an annual basis an estimated 99.6 percent of the MNF acres would continue to move toward older age classes. An estimated 587,100 acres are not suitable for timber management in this alternative, and only natural events would contribute to creating early successional habitat in these areas.

Table 2-22. Age Class Distribution Percentages in MPs 3.0 and 6.1 for Alternative 2

Time Frame	Percent of Age Class or Successional Stage – MP 3.0				
	Early (0-19 years)	Early to Mid (20-39 years)	Mid (40-79 years)	Mid to Late (80-119 years)	Late (≥120 years)
Current Distribution	4.2	4.5	33.0	54.5	3.8
End of 1st Decade	13.2	4.6	33.0	45.4	3.8
End of 5th Decade	20.0	19.0	17.8	17.9	25.3
End of 10th Decade	15.9	18.2	23.4	21.9	20.6
Time Frame	**Percent of Age Class or Successional Stage – MP 6.1**				
	Early (0-19 years)	**Early to Mid (20-39 years)**	**Mid (40-79 years)**	**Mid to Late (80-119 years)**	**Late (≥120 years)**
Current Distribution	3.7	4.8	23.9	61.6	6.0
End of 1st Decade	8.3	4.8	21.7	59.4	5.8
End of 5th Decade	10.2	8.1	13.1	18.4	50.2
End of 10th Decade	11.2	10.5	15.3	13.3	49.7

Alternative 2M – An estimated 329,400 acres are available for active management in this alternative. Annually, an estimated maximum of 3,400 acres would be regenerated into early successional stands, or about 0.4 percent of the total MNF acres. Another way of interpreting this is, on an annual basis approximately 99.4 percent of the MNF acres would continue to move toward older age classes. An estimated 588,000 acres are not suitable for timber management in this alternative, and only natural events would contribute to creating early successional habitat in these areas.

Table 2-23. Age Class Distribution Percentages in MPs 3.0 and 6.1 for Alternative 2M

Time Frame	Percent of Age Class or Successional Stage – MP 3.0				
	Early (0-19 years)	Early to Mid (20-39 years)	Mid (40-79 years)	Mid to Late (80-119 years)	Late (≥120 years)
Current Distribution	4.2	4.4	33.0	54.6	3.8
End of 1st Decade	13.1	4.5	33.0	45.6	3.8
End of 5th Decade	20.0	19.1	17.6	17.8	25.6
End of 10th Decade	15.8	18.0	23.7	22.0	20.6
Time Frame	**Percent of Age Class or Successional Stage – MP 6.1**				
	Early (0-19 years)	**Early to Mid (20-39 years)**	**Mid (40-79 years)**	**Mid to Late (80-119 years)**	**Late (≥120 years)**
Current Distribution	3.8	5.0	23.7	61.4	6.1
End of 1st Decade	8.5	5.0	21.7	58.8	6.0
End of 5th Decade	10.2	7.9	13.5	18.3	50.1
End of 10th Decade	11.4	10.9	15.3	13.4	49.0

Alternative 3 – An estimated 253,400 acres are available for timber harvest in this alternative. Annually, an estimated maximum of 2,400 acres would be regenerated into early successional stands, or about 0.3 percent of the total MNF acres. In this alternative about 99.7 percent of MNF acres, on an annual basis, would continue to move toward older age classes, with about 664,000 acres that would not be suitable for timber management.

Table 2-24. Age Class Distribution Percentages in MPs 3.0 and 6.1 for Alternative 3

Time Frame	Percent of Age Class or Successional Stage – MP 3.0				
	Early (0-19 years)	Early to Mid (20-39 years)	Mid (40-79 years)	Mid to Late (80-119 years)	Late (≥120 years)
Current Distribution	4.3	4.5	32.5	54.7	4.0
End of 1st Decade	13.0	4.5	32.5	46.0	4.0
End of 5th Decade	20.0	17.9	17.5	17.8	26.8
End of 10th Decade	14.5	18.5	24.6	22.2	20.2
Time Frame	**Percent of Age Class or Successional Stage – MP 6.1**				
	Early (0-19 years)	**Early to Mid (20-39 years)**	**Mid (40-79 years)**	**Mid to Late (80-119 years)**	**Late (≥120 years)**
Current Distribution	4.1	4.8	25.6	59.6	5.9
End of 1st Decade	5.8	4.8	25.6	57.9	5.9
End of 5th Decade	9.2	9.1	10.6	20.4	50.7
End of 10th Decade	10.0	9.7	14.2	12.7	53.4

Alternative 4 - This alternative has about 346,700 acres available for timber harvest. Annually, an estimated maximum of 5,200 acres would be regenerated into early successional stands, or about 0.6 percent of the total MNF acres. About 570,700 acres are not suitable for timber

harvest in this alternative.

Table 2-25. Age Class Distribution Percentages in MPs 3.0 and 6.1 for Alternative 4

Time Frame	Percent of Age Class or Successional Stage – MP 3.0				
	Early (0-19 years)	Early to Mid (20-39 years)	Mid (40-79 years)	Mid to Late (80-119 years)	Late (≥120 years)
Current Distribution	4.1	4.4	34.3	53.5	3.7
End of 1st Decade	13.9	4.4	34.3	43.7	3.7
End of 5th Decade	19.8	19.5	16.4	13.3	31.0
End of 10th Decade	11.8	15.7	26.5	23.5	22.5
Time Frame	**Percent of Age Class or Successional Stage – MP 6.1**				
	Early (0-19 years)	**Early to Mid (20-39 years)**	**Mid (40-79 years)**	**Mid to Late (80-119 years)**	**Late (≥120 years)**
Current Distribution	3.6	4.6	24.1	61.7	6.0
End of 1st Decade	12.3	4.6	22.1	56.0	5.0
End of 5th Decade	10.6	7.4	17.0	15.7	49.3
End of 10th Decade	9.8	10.1	18.0	15.1	47.0

Indicators and Effects for Issue #2

Spruce Restoration - Most of the spruce restoration assigned to MP 4.1 is designed for passive management. For most of MP 4.1 and for MPs that do not allow active management, the forest communities will continue to age naturally. The total amount of potential spruce restoration (both passive and active) that could occur is shown in Table 2-26 by alternative.

Table 2-26. Total Acres of Potential Spruce Restoration Areas

Alternative 1	Alternative 2	Alternative 2M	Alternative 3	Alternative 4
130,000	140,000	140,000	140,000	140,000

There is little difference in overall potential spruce restoration under any alternative, and no difference among the action alternatives that could be implemented. However, the amount of acres available for active spruce restoration does vary somewhat by alternative. These differences are shown in Table 2-27 as the acres of northern hardwood stands in MP 4.1, but not in WVNFS suitable habitat, that would be at least 80 years old at the end of the fifth decade. All potential 4.1 acres and potential suitable 4.1 acres are both shown because restoration could occur outside of suitable timberlands.

Table 2-27. Acres Available for Active Spruce Restoration 50 Years From Today

Acres Available for Restoration	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
All Potential Acres in MP 4.1	0	23,000	24,000	9,000	34,000
Potential Suitable Acres in MP 4.1	0	9,700	10,000	6,200	16,800

Although Table 2-27 is only intended as a relative comparison of areas that could provide active spruce restoration opportunities by alternative, the table shows that the most opportunities could occur under Alternative 4, followed in descending order by Alternatives 2M, 2, 3, and 1.

Oak Restoration - Unlike spruce restoration, oak restoration would focus on active vegetation management tools such as even-aged timber harvest and prescribed fire. Although some harvest-related oak restoration could also occur in MPs 3.0 and 8.1, most of the direction and opportunities for oak restoration are associated with MP 6.1. This MP area not only includes a majority of the declining oak communities on the Forest, but it also has suitable timberlands with a wildlife habitat management emphasis. Suitable timber acres of mixed oak and pine-oak forest types in MP 6.1 are shown in Table 2-28 by alternative. These acres represent the most likely area where oak restoration would occur using commercial timber harvest as a tool. Table 2-28 shows that Alternative 4 would have the most acres, followed in descending order by Alternatives 2, 1, and 3. Alternative 4 would have nearly double the acres of Alternative 3.

Table 2-28. Acres of Oak Forest Types Within MP 6.1 by Alternative

Oak Types within MP 6.1	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Acres of mixed oak in MP 6.1	66,300	97,500	97,300	55,700	106,000
Acres of pine-oak in MP 6.1	18,600	28,500	28,500	12,200	31,200
Total Acres	84,900	126,000	125,800	67,900	137,200

For all alternatives, additional oak forests would be available for treatment outside of the suitable acres displayed in Table 2-28. These areas could be treated with a mixture of timber harvest and prescribed fire to achieve oak regeneration; however, funding would likely have to come from different sources than the Timber program. The most total oak forests available would be in Alternative 4 (213,700 acres), followed by Alternative 2 (191,900 acres), Alternative 2M (188,500 acres), Alternative 1 (136,800 acres), and Alternative 3 (110,400 acres).

Acres of Fire Regime I Condition Class 3 and Fire Regime III Condition Class 2 in MPs 3.0, 6.1, and 8.1 by alternative - Over the short and long term, fire management would focus on those areas considered most at risk due to their departure from their natural fire regimes. On the MNF these areas have been identified and mapped as Fire Regime I, Condition Class 3, and Fire Regime III, Condition Class 2. Table 2-28 shows the acres of these FRCC that occur in MPs 3.0, 6.1, and 8.1 by alternative. This combination of MPs and FRCCs represent the most likely areas where oak restoration would occur using prescribed fire as a tool. Table 2-29 shows Alternative 4 with the most acres, followed in descending order by Alternatives 2, 2M, 1, and 3.

Table 2-29. Acres of FRCC 3 and 2 in MPs 3.0, 6.1, and 8.1 by Alternative (mixed oak and pine-oak forest types only)

Alternative	Management Prescription	Acres by Fire Regime (FR) and Condition Class (CC)		MP Subtotal Acres	Total Acres for All MPs
		FR I, CC 3	FR III, CC 2		
Alt. 1	MP 3.0	13,800	32,200	46,000	**183,200**
	MP 6.1	78,000	59,200	137,200	
Alt. 2	MP 3.0	3,000	16,400	19,400	**198,200**
	MP 6.1	75,100	79,000	154,100	
	MP 8.1	21,100	3,600	24,700	
Alt. 2M	MP 3.0	3,000	16,400	19,400	**195,700**
	MP 6.1	73,200	78,400	151,600	
	MP 8.1	21,100	3,600	24,700	
Alt. 3	MP 3.0	3,000	15,800	18,800	**129,900**
	MP 6.1	31,200	55,200	86,400	
	MP 8.1	21,100	3,600	24,700	
Alt. 4	MP 3.0	3,000	16,400	19,400	**217,300**
	MP 6.1	86,000	87,200	173,200	
	MP 8.1	21,100	3,600	24,700	

Overall, the best opportunities for oak restoration using a combination of timber harvest and prescribed fire tools would be in Alternative 4, followed in descending order by Alternatives 2, 2M, 1, and 3.

Timber Supply

Acres of land suited and not suited for timber management by alternative - In Alternative 1, the forested acres considered suited for timber management are located in MPs 2.0, 3.0, 4.0, and 6.1. In Alternatives 2 through 4 these MPs shift to 3.0, 4.1, and 6.1. Most of the lands in MP 4.1 that are suitable habitat for the endangered West Virginia northern flying squirrel (WVNFS) are not suitable for timber management and will not be actively managed except for research or administrative study purposes. Those lands in MP 4.1 that are not in WVNFS suitable habitat but have a spruce component, may be actively managed for restoration of the spruce-hardwood community, but are not considered as suitable for timber management. Only those stands that do not have a spruce component in MP 4.1 are considered to be suitable for timber management. Table 2-30 breaks out the tentatively suitable acres into categories that are considered not suited for timber management by MP. Many of the constraint categories were combined to show collective acres in order to avoid double-counting acres where two or more of the areas overlap.

Table 2-30. Lands Suited and Available for Commercial Timber Harvest

Land Class Description	Acres				
	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Total modeled acres	912,516	912,516	912,516	912,516	912,516
Wilderness (MP 5.0)	-78,738	-78,738	-78,738	-78,738	-78,738
Recommended Wilderness (MP 5.1)	-0	-27,657	-27,657	-99,148	-0
Backcountry Recreation (MP 6.2)	-124,125	-95,993	-105,223	-222,854	-49,716
Special Areas (MP 8.0)	-115,979	-69,920	-72,820	-57,746	-69,920
Indiana Bat Primary Range in MPs 3.0, 4.1, 6.1	-0	-148,061	-146,064	-92,971	-164,521
Tentatively unsuitable WV Northern Flying Squirrel Suitable Habitat* Eligible Wild or Scenic WSR Corridors** Indiana Bat Key Areas and Hibernacula*** Very High and Distinct Scenic Integrity Areas Perennial & Intermittent Stream Channel Buffers Existing suitable base adjustment****	-261,464	-161,852	-152,629	-107,693	-202,875
Suited Timberland Available for Harvest	332,200	330,300	329,400	253,400	346,700
Percent of Forest Land Base	**36%**	**36%**	**36%**	**28%**	**38%**

*In Alternative 1, WV northern flying squirrel suitable habitat is in Opportunity Area 832, part of MP 8.0
**Includes all rivers in Alternative 1, but only Wild or Scenic classification rivers in Alternatives 2, 3 and 4
***Calculated for Alternative 1, but incorporated into Indiana bat primary range for Alternatives 2, 3, and 4
****Includes adjustments in Alternative 1 for land acquisition and exchanges, and removal of the "floating" timber base referred to in 1986 but never clearly identified on the ground

Potential cubic board feet of ASQ by alternative - Table 2-31 displays the projected annual timber harvest volume for each alternative during the first, fifth, and tenth decades in order to show both short- and long-term effects. The volume projections are based on growth and yield estimates from the Spectrum computer model. These estimates have not been adjusted to consider projected budget or personnel needed to plan, analyze, and implement projects to achieve these potential outputs.

Table 2-31. Projected Annual Volume of Timber Harvested by Decade in MCF (Thousand Cubic Feet) and MMBF (Million Board Feet)

Decade	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
First	108 MMCF 646 MMBF	105 MMCF 632 MMBF	105 MMCF 629 MMBF	83 MMCF 498 MMBF	133 MMCF 800 MMBF
Fifth	108 MMCF 646 MMBF	105 MMCF 632 MMBF	105 MMCF 629 MMBF	83 MMCF 498 MMBF	100 MMCF 601 MMBF
Tenth	108 MMCF 646 MMBF	105 MMCF 632 MMBF	105 MMCF 629 MMBF	83 MMCF 498 MMBF	113 MMCF 679 MMBF

Acres treated by harvest method by alternative - Table 2-32 shows the amount of acres that the Spectrum model predicted would be treated by different harvest method by alternative, over the next decade, the fifth decade, and the tenth decade.

Table 2-32. Projected Annual Acreage of Timber Harvest by Harvest Method by Decade

Acres in Decade 1: 2006-2015					
Harvest Method	**Alt. 1**	**Alt. 2**	**Alt. 2M**	**Alt. 3**	**Alt. 4**
Intermediate Harvests	27,411	11,324	11,335	20,382	0
Two-aged Harvests	18,092	16,396	17,239	8,602	23,800
Clearcuts with Reserve Trees	5,860	12,735	11,862	9,435	14,963
Shelterwood Harvests	3,458	4,841	4,902	2,345	12,810
Totals	54,821	45,296	45,338	40,764	51,573
Acres in Decade 5: 2046-2055					
Intermediate Harvests	639	1,032	848	560	2,614
Two-aged Harvests	15,788	16,633	16,663	12,749	15,337
Clearcuts with Reserve Trees	9,416	9,920	9,779	8,893	14,701
Shelterwood Harvests	31,778	24,507	24,232	16,777	10,929
Totals	57,621	52,092	51,522	38,977	43,581
Acres in Decade 10: 2096-2105					
Intermediate Harvests	19,615	9,460	12,480	8,706	8,758
Two-aged Harvests	14,917	16,008	15,640	12,622	18,056
Clearcuts with Reserve Trees	10,592	13,181	12,567	9,626	15,894
Shelterwood Harvests	14,876	13,375	13,348	9,288	9,053
Totals	60,000	52,025	54,035	40,184	51,761

Mineral Resources

Percent of federally owned natural gas acres available for exploration and development by alternative - Table 2-33 shows that Forest Plan standards that prohibit surface occupancy within federal oil and gas leases result in different acreages by alternative of federally owned natural gas unavailable for exploration, development or production. Prohibition standards are found in MPs 5.0, 5.1, 6.2, most 8.0 areas, and municipal watersheds. These are acres that are unavailable because they cannot be reached by directionally drilling from federally owned gas outside of the boundary of the area in which surface occupancy is prohibited.

Table 2-33. Acres and Percent of Federally Owned Gas within MNF Unavailable for Gas Leasing and Development by Alternative

Affected Area	**Alt. 1**	**Alt. 2**	**Alt. 2M**	**Alt. 3**	**Alt. 4**
	Acres	**Acres**	**Acres**	**Acres**	**Acres**
MP 5.0	76,000	76,000	76,000	76,000	76,000
MP 5.1, 6.2, or SPNM portions of 8.1	66,000	57,000	71,000	127,000	38,000
MP 8 (excluding MP 8.1)	1,000	1,000	1,000	1,000	1,000
Municipal watersheds	3,000	0	0	0	0
Total acres affected	**146,000**	**134,000**	**148,000**	**204,000**	**115,000**
Percent of federally owned gas affected	**25%**	**23%**	**26%**	**36%**	**20%**

Potential natural gas resources available for production from the MNF by alternative - Table 2-34 shows how the amount of federally owned gas available for exploration and development affects the potential natural gas production from the federal oil and gas estate within the Forest. Under Alternatives 1 and 2M, there is a 19 percent chance for discovery and production of 195 Bcf of natural gas. Alternative 2 has an estimated 199 Bcf due to an additional 12,000 more acres available for exploration in Alternative 2. Under Alternative 3, the acres unavailable (204,000) have resulted in less gas production potential of 30 Bcf than Alternative 1. Under Alternative 3, 73 percent of the total federal gas potential could be produced. Under Alternative 4, which has 31,000 acres more than Alternative 1 available, the most—209 Bcf or 92 percent of the total federal gas potential—gas production could occur as compared to the other alternatives.

Table 2-34. Potential Natural Gas Production from the MNF by Alternative

Gas Production Potential	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Potential (19 percent chance) for Production from federally owned oil and gas within the MNF (in billion cubic feet)	195	199	195	165	209
Percent of total potential federal gas production if only wilderness were unavailable	86%	88%	86%	73%	92%

Recreation and Wilderness

Acres of backcountry recreation areas by alternative – The total backcountry recreation opportunities on the Forest are calculated by adding up the amount of land allocated to MPs 5.0 (Designated Wilderness), 5.1 (Recommended Wilderness), 6.2 (Backcountry Recreation), and 8.1 Semi-Primitive Non-Motorized areas in the Spruce Knob-Seneca Rocks NRA. Lands emphasizing backcountry recreation vary by alternative as seen in Table 2-35.

Table 2-35. Total Backcountry Recreation Opportunity Acres by Alternative

Recreation Opportunity Area	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Designated Wilderness (5.0)	78,700	78,700	78,700	78,700	78,700
Recommended Wilderness (5.1)	0	27,700	27,700	99,400	0
Backcountry Recreation (6.2)	124,500	97,500	106,800	225,900	51,000
SPNM Acres within NRA (8.1)	0	24,900	24,900	13,000	24,900
Total Acres	**203,200**	**228,800**	**238,100**	**417,000**	**154,600**
Percent of Forest	**22%**	**25%**	**26%**	**45%**	**17%**

Alternative 3 would have the most total area, primarily because it has nearly twice the amount of MP 6.2 area than Alternative 1, the current condition. Alternative 2 would provide backcountry recreation opportunities in about 3 percent more (25,600 acres) of the entire Forest than

Alternative 1, Alternative 2M would provide backcountry recreation opportunities in about 4 percent more (34,900 acres) of the entire Forest than Alternative 1. Alternative 4 would have 5 percent less of the Forest in backcountry recreation emphasis than the current condition as represented by Alternative 1.

Acres of areas recommended for wilderness study by alternative - MP 5.1 emphasizes maintaining wilderness character in a SPNM setting. Direction for this MP includes strong constraints on management actions that could detract from the SPNM setting or the wilderness character of each area. Evidence of development is expected to be extremely low. MP 5.1 allocations were made from the pool of the 18 Inventory Roadless Areas identified and described in detail in Appendix C to this EIS. The allocations vary by alternative as seen in Table 2-36.

Table 2-36. Recommended Wilderness (5.1) Areas by Alternative

Alternatives 1 and 4		Alternatives 2 and 2M		Alternative 3	
Area	**Acres**	**Area**	**Acres**	**Area**	**Acres**
None	0	Cheat Mountain	7,955	Big Draft	5,395
		Cranberry Expansion	12,165	Cheat Mountain	7,955
		Dry Fork	739	Cranberry Expansion	12,165
		Roaring Plains West	6,825	Dry Fork	739
				East Fork Greenbrier	10,153
				Gaudineer	6,727
				Middle Mountain	12,197
				Roaring Plains West	6,825
				Seneca Creek	24,974
				Spice Run	6,171
				Turkey Mountain	6,111
Areas	**0**	**Areas**	**4**	**Areas**	**11**
Total Acres	**0**	**Total Acres**	**27,700**	**Total Acres**	**99,400**

Recreation Opportunity Spectrum (ROS) Class distribution by alternative - Assigning 5.1, 6.2, and 8.1 SPNM MPs directly affects how much land is available for other MPs on the Forest, and indirectly affects how these lands would be managed over the planning period, and what other types of recreation opportunities may be available. The recreation settings and opportunities can be estimated to a relative degree by comparing the ROS class distribution that would be created by alternative. The existing condition percentages lean rather heavily toward the RN and SPM Classes due primarily to the legacy of roads, most of which were created during the extensive logging period of 70-120 years ago. The desired conditions recognize that many roads will continue to disappear or be decommissioned over time. Thus, all alternatives would have more potential SPNM Class in the future. The amount, as seen in Table 2-37, differs by alternative, reaching a high point of 54 percent of the Forest in Alternative 3, and a low point of 34 percent in Alternative 4. Conversely, there is less SPM Class than present in all alternatives, ranging from 13 percent in Alternative 3 to 21 percent in Alternative 4.

Table 2-37. ROS Class Distribution by Alternative in Percent of Forest

ROS Class	Existing Condition	Alt. 1 Desired Condition	Alt. 2 Desired Condition	Alt. 2M Desired Condition	Alt. 3 Desired Condition	Alt. 4 Desired Condition
Primitive	0	0	0	0	0	0
Semi-Primitive Non-Motorized	21%	40%	40%	41%	54%	34%
Semi-Primitive Motorized	35%	19%	18%	18%	13%	21%
Roaded Natural	44%	41%	42%	41%	33%	45%
Rural	<1%	<1%	<1%	<1%	<1%	<1%
Urban	0	0	0	0	0	0

In terms of recreational opportunities, SPNM would provide the potential for more challenging and non-motorized experiences in essentially undeveloped settings, whereas RN would provide the potential for both motorized and non-motorized experiences in a natural setting that would also have signs of development. SPM would restrict motorized opportunities but there may still be signs of development, such as recent timber harvest. Alternatives 1, 2, and 2M all show a relative balance between the RN and SPNM ROS Classes, with Alternative 2M showing a virtual one-to-one relationship. Alternative 3 would provide more backcountry recreation opportunities than any other alternative, while Alternative 4 would have the highest percentage of RN opportunities for those more interested in motorized recreation.

Percent contribution to backcountry recreation opportunities in West Virginia by alternative - The alternatives would contribute anywhere from 92 percent (Alternative 4) to 97 percent (Alternative 3) of the backcountry recreation settings on public lands in West Virginia. Under any of the alternatives considered, the Monongahela NF would continue to be the primary provider of backcountry recreation settings and opportunities in the State of West Virginia.

Scenic Environment

Acres of even-aged harvest, intermediate thinning, and prescribed fire - Table 2-38 compares activities by alternative that could affect visual quality on the Forest over the next two decades, using annual averages from the model. It should be noted that Scenic Integrity Objectives are designed to mitigate any long-term effects to the landscape's scenic integrity.

Table 2-38. Maximum Potential Activities That May Affect Scenic Integrity by Alternative
(Estimated annual average of acres for the first two decades, based on Spectrum outputs)

Activity Group	Maximum Annual Activity Acres				
	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Acres of Regeneration Harvest	3,450	3,650	3,600	2,670	4,450
Acres of Intermediate Thinning	2,120	870	860	1,610	740
Acres of Prescribed Fire	300	3,000	3,000	300	7,500
Totals	**5,870**	**7,520**	**7,460**	**4,580**	**12,690**

Overall, Alternative 3 would have the least amount of visual impacts based on the activity groups above, followed in ascending order by Alternatives 1, 2M, 2, and 4.

Road Transportation System

Relative potential change in Forest Classified Roads by 2015 related to timber harvest by alternative - New road construction over the planning period is most likely to be associated with timber harvest. Estimated acres of timber harvest by alternative are shown in Table 2-39.

Table 2-39. Acres of Projected Maximum Timber Harvest by Alternative in the First Planning Decade

Estimated Maximum Harvest Acres for the Next Decade by Alternative				
Alternative 1	Alternative 2	Alternative 2M	Alternative 3	Alternative 4
54,821	45,297	45,338	40,764	51,573

Potential change in Forest Classified Roads related to harvest distance from roads by alternative - Table 2-40 shows maximum acres harvested and associated roads that may be needed for the first decade of the planning horizon, while Table 2-41 shows the same information for the fifth decade (40-50 years from now) of the planning horizon.

Table 2-40. Miles of Road by Alternative for Decade 1 Based on Maximum Harvest Levels and Harvest Distance From Roads

Indicator	Distance to Road (Miles)	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Maximum Acres Harvested	0 to 3/8	44,911	42,133	42,349	39,154	45,460
	3/8 to 6/8	7,328	3,060	2,989	1,057	5,316
	6/8 to 9/8	1,482	80	0	553	500
	> 9/8	1,100	24	0	0	288
	Totals	54,821	45,297	45,338	40,764	51,573
Harvest Using New and Existing Maintenance Level 3, 4, and 5 Roads, and Reconstructing Existing Maintenance Level 1 and 2 Roads	0 to 3/8	0.0	0.0	0.0	0.0	0.0
	3/8 to 6/8	15.4	6.4	6.4	2.3	11.3
	6/8 to 9/8	3.4	0.4	0.0	1.5	1.1
	> 9/8	2.6	0.4	0.0	0.0	0.8
	Totals	21.4	7.1	6.4	3.8	13.1
Harvest Using New Maintenance Level 3, 4, and 5 Roads, and Reconstructing Existing Maintenance Level 1 and 2 Roads	0 to 3/8	0.0	0.0	0.0	0.0	0.0
	3/8 to 6/8	15.4	6.4	6.4	2.3	11.3
	6/8 to 9/8	6.8	0.8	0.0	3.0	2.3
	> 9/8	7.9	1.1	0.0	0.0	2.3
	Totals	30.0	8.3	6.4	5.3	15.8
Estimated Range of Road Miles for the Decade		21 - 30	7 – 8	6 – 6	4 – 5	13 - 16

Table 2-41. Miles of Road by Alternative for Decade 5 Based on Maximum Harvest Levels and Harvest Distance From Roads

Indicator	Distance to Road (Miles)	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Maximum Acres Harvested	0 to 3/8	27,037	19,149	21,404	16,386	18,297
	3/8 to 6/8	12,364	12,586	10,401	11,468	10,777
	6/8 to 9/8	7,909	13,113	12,682	5,504	4,460
	> 9/8	10,312	7,244	7,034	5,619	10,047
	Totals	57,622	52,092	51,521	38,977	43,581
Harvest Using New and Existing Maintenance Level 3, 4, and 5 Roads, and Reconstructing Existing Maintenance Level 1 and 2 Roads	0 to 3/8	0.0	0.0	0.0	0.0	0.0
	3/8 to 6/8	25.9	26.3	21.8	24.0	22.5
	6/8 to 9/8	16.5	28.5	31.5	11.6	9.4
	> 9/8	27.0	15.4	15.0	12.4	32.6
	Totals	69.4	70.1	68.3	48.0	64.5
Harvest Using New Maintenance Level 3, 4, and 5 Roads, and Reconstructing Existing Maintenance Level 1 and 2 Roads	0 to 3/8	0.0	0.0	0.0	0.0	0.0
	3/8 to 6/8	25.9	26.3	21.8	24.0	22.5
	6/8 to 9/8	33.0	54.8	53.3	23.3	18.8
	> 9/8	65.3	46.1	45.0	36.0	63.0
	Totals	124.1	127.1	120.0	83.3	104.3
Estimated Range of Road Miles for the Decade		69 –124	70 –127	68 –120	48 –83	64 -104

As shown in Table 2-40, Alternative 1, which is harvesting the most timber over the decade, would also need the most roads to harvest that timber. Alternative 1 is followed in order by Alternatives 4, 2, 2M, and 3. That all alternatives have such a low overall need for new road is closely related to the high amount of harvest close to existing roads that has been projected.

By the fifth decade, represented in Table 2-41, road mile patterns have shifted somewhat. Alternatives 1, 2, and 2M have very similar amounts of predicted road mileage, Alternative 4 has slightly less mileage, and Alternative 3 substantially less. For all alternatives, potential road miles range from 48 to 127 for the entire decade, which averages out to 4.8 to 12.7 miles per year. More road miles are needed in all alternatives because more harvest is projected in stands farther from existing roads. The ranges of road miles for the alternatives are greater as well, indicating that there are more road options available.

Relative potential change in public motorized access related to MP allocation by alternative - Another way to look at opportunities for road construction, reconstruction, and public motorized access is by comparing the amount of land allocated by alternative to MPs that restrict these activities. These MPs are Designated Wilderness (5.0), Recommended Wilderness (5.1), Backcountry Recreation (6.2), and selected Special Areas, such as NRA backcountry recreation areas (8.1 SPNM), Ecological Areas (8.4), and Candidate Research Natural Areas (8.5). The acres of these MPs by alternative are shown in Table 2-42.

Table 2-42. Acres of MPs that would Prohibit Public Motorized Access by Alternative

Area	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
MP 5.0 Acres	78,700	78,700	78,700	78,700	78,700
MP 5.1 Acres	0	27,700	27,700	99,400	0
MP 6.2 Acres	124,500	97,500	106,800	225,900	51,000
MP 8.1 SPNM Acres	0	24,900	24,900	13,000	24,900
MPs 8.4, 8.5	2,030	2,020	3,960	2,020	2,020
Total Acres	**205,230**	**230,820**	**242,060**	**419,020**	**156,620**

The alternative that would have the most direct effect on prohibiting public motorized access is Alternative 3, followed in descending order by Alternatives 2M, 2, 1, and 4. Compared to the current condition, represented by Alternative 1, Alternatives 2 and 2M would increase the amount of land that is off-limits to public motorized access by 25,590 acres and 36,830 acres, respectively. These acres represent about 3 and 4 percent of the Forest, respectively. Alternative 3 would more than double the current acres, and the increase would represent over 23 percent of the Forest land base. Conversely, Alternative 4 would reduce the amount of land off-limits to public motorized access by 48,600 acres, or about 5 percent of the Forest. Alternative 4 would accommodate those who favor more public motorized access on the Forest, whereas those who favor less public motorized access would be best accommodated by Alternative 3, and to a much lesser extent by Alternatives 2M and 2.

Social and Economic Environment

Indicators and Effects for Issue #1

Population - Table SO-3, included under Current Conditions, shows population figures for each of the 10 counties. Forest Plan alternatives could have an indirect influence on county or community populations, but how and where this influence would occur cannot be predicted with any accuracy. For example, all alternatives have the potential to increase timber production, and an increase could bring more forestry and manufacturing jobs to the area. Alternative 4 would potentially increase production the most, followed in order by Alternatives 1, 2, 2M, and 3. Whether these jobs translate into population increases would depend on how much new and relatively permanent industry is created within the Forest region. Timber that is shipped and processed outside of the region may have little if any effect on local populations. Because the difference in the maximum potential of timber production between alternatives is not substantial (30 mmbf), it is doubtful that this influence on population would vary much by alternative. Conversely, the perception of the Forest region as a retirement area or less stressful place to live may be enhanced by alternatives that emphasize backcountry recreation in a rural setting and provide less opportunity for commodity production, increased logging traffic, or smoke from prescribed fire. However, even under Alternative 4, which has the highest amount of production-related activities, over 60 percent of the Forest would receive little or no ground-disturbing activities (see *Soil Resource* section), and there would be abundant opportunities for recreation in a rural and relatively undisturbed environment. Therefore, it is doubtful that this influence on population would vary much by alternative or have much of an effect.

Lifestyles and Social Organization - Under all alternatives, rural communities would likely continue to provide some opportunities for resource-dependent lifestyles; however, these communities would also likely continue to look for opportunities to diversify their economies. All alternatives have a mix of opportunities, goods, and services that would provide some flexibility that may help communities to adapt or diversify their economies in the future. Although the differences between alternatives are not great, Alternative 4 may provide somewhat more opportunity to increase forestry-related or wood product manufacturing jobs in local communities, whereas Alternative 3 may provide more outdoor recreation or recreation-based tourism opportunities. Alternatives 2 and 2M would likely have intermediate effects compared to Alternatives 4 and 3. Alternative 1, No Action, would represent the least amount of change from the current situation. The overall effects of any alternative alone, however, would not likely have a dramatic influence on the existing lifestyles or social organization of communities in the Forest region.

Attitudes, Beliefs and Values Toward Land Use Patterns - As noted in the Current Conditions secton, rural areas within the Forest region are expected to grow only slightly over the next few decades. Many of the rural areas encompass large areas of federally-managed land. Under all alternatives, land use patterns would likely remain the same, with a mix of managed and unmanaged land. Under Alternative 4, there would likely continue to be a mix of managed and unmanaged land, with a somewhat higher percentage of managed land than under the remaining alternatives. Under Alternative 3, there might be some shift to wildland interface areas as new residents, attracted to non-motorized recreation and/or roadless features, move in. Alternatives 2 and 2M would not indicate a significant change from Alternative 1, which represents the current situation. However, despite the increase in locationally independent lifestyles such as telecommuting or entrepreneurship, it has been difficult to discern anything like a rural renaissance in West Virginia. It is more likely that there would continue to be a mix of attitudes, beliefs, and values toward land uses and patterns in local counties and communities that tend to polarize around Forest-related issues such as wilderness, commodity production, and recreation uses. These attitudes, beliefs, and values would not likely change by alternative or because of the alternatives.

Civil Rights - Under all alternatives, it is likely that the people in the Forest region will become racially more diverse, while remaining largely white and Anglo-Saxon. Although few data are available, there is a sense that the region's minorities use and relate to National Forests in ways similar to the region's predominantly white population, and that these relationships would likely continue. Effects would not likely change by alternative or because of the alternatives.

Environmental Justice - All federal actions, including forest plan revision, are required by Executive Order 12898 to address questions of equity and fairness in resource decision making. This section considers the effects of the alternatives to identify potentially disproportionate effects on minority and low-income communities. Ethnicity and income levels for local counties and communities were summarized in the Current Conditions section. There is no indication that any of the alternatives would adversely or disproportionately affect racial minorities or low income groups. If any portion of the predicted increases in employment and income reported below come to pass, they should have positive effects on local communities and counties whose current median income levels are considered well below the national average.

Employment and Income

Employment - The Forest generates money through various sources, and this money has the ripple effect of creating or sustaining jobs in its area of influence. These jobs were estimated for the next ten years, and they are displayed in Table 2-45.

Table 2-45. Employment by Source by Alternative (Average Annual, Decade 1)

Source	Number of Forest-Linked Jobs					
	Current	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Recreation Visits	596	753	753	753	753	753
Wildlife and Fish Related Visits	240	322	322	322	322	322
Livestock Grazing	6	6	6	6	6	6
Timber Harvest	142	748	746	742	577	945
Mineral Operations	12	12	12	12	12	12
Payments to States/Counties	54	54	54	54	54	54
Other Forest Service Expenditures	253	291	283	283	271	299
Total Forest-Linked Jobs	1,303	2,186	2,176	2,172	1,995	2,391
Percent Change from Current	---	67.8%	67.0%	66.7%	53.1%	83.5%

Forest Service-linked employment is expected to be relatively static under all alternatives in the next 10 years for all Forest sources except timber harvest. Timber-related increases in employment are estimated by alternative based on maximum projected volume outputs generated by the Spectrum model to achieve desired vegetation conditions for the Forest. Increases in projected employment over current levels range from 53 percent in Alternative 3, to 83 percent in Alternative 4.

Table 2-46 displays how the jobs generated in Table 2-45 would be distributed within the major industrial sectors found in the MNF 10-County Region. The Forest-linked jobs would ripple through all sectors of the economy; however, some sectors would be affected more than others. The Agriculture and Manufacturing sectors, for example, show triple or quadruple their jobs, while other sectors show more modest gains, depending on the alternative. The larger increase in the Agriculture and Manufacturing sectors are a directly related to the substantial increase projected for the timber harvest source, whereas the other sectors are showing more indirect or induced effects from projected increases in all source revenues.

Table 2-46. Employment by Industry by Alternative (Average Annual, Decade 1)

Industry	Number of Forest-Linked Jobs					
	Current	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Agriculture	50	224	202	201	181	247
Mining	18	21	21	21	20	21
Utilities	4	7	7	7	6	8
Construction	23	29	29	29	28	31
Manufacturing	80	343	362	359	265	457
Wholesale Trade	51	79	79	79	74	85
Transportation & Warehousing	22	46	47	47	40	54
Retail Trade	232	311	311	311	302	321
Information	6	10	10	10	10	11
Finance & Insurance	7	14	14	14	12	16
Real Estate & Rental & Leasing	20	30	29	29	28	32
Professional, Scientific & Tech Services	23	34	34	34	31	37
Management of Companies	2	5	5	5	4	5
Administration and Waste Management	11	20	20	20	19	22
Educational Services	5	8	8	8	7	8
Health Care & Social Assistance	40	69	69	69	62	76
Arts, Entertainment, and Recreation	47	69	69	69	69	70
Accommodation & Food Services	422	559	559	559	553	567
Other Services	31	67	67	66	57	77
Government	209	241	236	236	229	245

Income - The money and jobs that the Forest generates through its programs and payments also ripple through the economy as income. This income was estimated by alternative for the next 10 years and is displayed below in Table 2-47.

Table 2-47. Labor Income by Source by Alternative (Average Annual, Decade 1)

Source	Forest-Linked Income (in Thousands of 2005 Dollars)					
	Current	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Recreation Visits	12,921	16,348	16,348	16,348	16,348	16,348
Wildlife and Fish Related Visits	4,929	6,855	6,855	6,855	6,855	6,855
Livestock Grazing	38	38	38	38	38	38
Timber Harvest	4,629	24,846	24,546	24,390	19,201	31,062
Mineral Operations	427	427	427	427	427	427
Payments to States/Counties	2,136	2,136	2,136	2,136	2,136	2,136
Other Forest Service Expenditures	10,783	12,421	12,073	12,061	11,538	12,742
Total Forest-Linked Income	$35,863	$63,071	$62,423	$62,255	$56,544	$69,608
Percent Change from Current	---	75.9%	74.1%	73.6%	57.7%	94.1%

Similar to jobs, Forest-linked income is expected to be relatively static under all alternatives for all Forest sources except timber harvest. Increases in projected income over current levels range from 58 percent in Alternative 3, to 94 percent in Alternative 4. The income percentage increases are somewhat higher than the job percentage increases in Table 2-43 because the additional timber and manufacturing jobs created would provide relatively high income for jobs for this region.

Table 2-48 displays how the income generated in Table 2-47 would be distributed within the major industrial sectors found in the Forest's area of influence. Not all income is accounted for as some would fall outside of the sectors listed in the table.

Forest-linked income would ripple through all sectors of the economy; however, some sectors would be affected more than others. The Agriculture and Manufacturing sectors, for example, nearly triple or quadruple their jobs, while other sectors show more modest gains. Again, the larger increases in the Agriculture and Manufacturing sectors are a directly related to the substantial increase projected for the timber harvest source, whereas the other sectors are showing more indirect or induced effects from projected increases in all source revenues.

Table 2-48. Labor Income by Industry by Alternative (Average Annual, Decade 1)

Industry	Forest-Linked Income (in Thousands of 2005 Dollars)					
	Current	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Agriculture	1,244	8,313	7,368	7,319	6,565	9,215
Mining	1,123	1,336	1,334	1,334	1,322	1,348
Utilities	324	657	663	661	575	759
Construction	796	1,010	996	994	944	1,056
Manufacturing	2,572	10,935	11,517	11,462	8,416	14,568
Wholesale Trade	1,989	3,053	3,065	13,044	2,862	3,286
Transportation & Warehousing	667	1,483	1,518	1,513	1,267	1,774
Retail Trade	4,158	5,662	5,643	5,638	5,462	5,863
Information	190	308	307	306	283	334
Finance & Insurance	241	506	504	502	440	579
Real Estate & Rental & Leasing	315	475	468	467	432	511
Professional, Scientific & Tech Services	773	1,182	1,174	1,171	1,076	1,284
Management of Companies	136	260	260	260	232	293
Administration and Waste Management	202	340	341	341	311	375
Educational Services	73	122	121	121	111	134
Health Care & Social Assistance	1,299	2,240	2,217	2,211	2,013	2,466
Arts, Entertainment, and Recreation	903	1,323	1,323	1,322	1,313	1,334
Accommodation & Food Services	7,611	10,329	10,325	10,323	10,239	10,426
Other Services	556	1,242	1,242	1,237	1,059	1,449
Government	10,691	12,295	12,037	12,028	11,622	12,555

Federal Payments to Counties - The Forest makes payments to counties through two primary sources: 25% Fund/Stabilized Payments, and Payments In Lieu of Taxes (PILT). The 25% Fund/ Stabilized Payments are made to the State of West Virginia for redistribution to counties in proportion to the number of acres of National Forest System land within each county. Payments are generally limited to use for schools and roads. Currently, Barbour, Grant, and Nicholas Counties receive the 25 Percent Fund, while the other seven counties in the Forest region receive Stabilized Payments. Forest payments for all counties in 2005 are shown in Table 2-43.

Table 2-43. Forest-related 25 Percent Fund/Stabilized Payments to Counties for 2005

County	Payment	% of Total
Barbour County	$8	0%
Grant County	$43,156	2%
Greenbrier County	$218,885	12%
Nicholas County	$16,981	1%
Pendleton County	$130,659	7%
Pocahontas County	$666,828	36%
Preston County	$8,460	0%
Randolph County	$434,986	23%
Tucker County	$214,388	11%
Webster County	$142,318	8%
Totals	**$1,876,669**	**100%**

Source: Albuquerque Service Center, USDA Forest Service

If the counties that have chosen Stabilized Payments return to the 25 Percent Fund, the amounts they receive would shift to 25 percent of the annual revenues generated by the Forest. Based on estimates from the IMPLAN model, these revenues could be potentially much higher than they have been in the recent past. However, based on recent history, Forest revenues have fluctuated greatly, depending primarily on how much timber is produced. Projected timber production would be highest in Alternative 4, followed closely by Alternatives 1, 2, and 2M, which have fairly similar production potential, and then Alternative 3, which has considerably less potential.

Payments in Lieu of Taxes (PILT) are paid to the State of West Virginia for redistribution to the governments of counties containing specific types of federal lands, including national forests. Counties receive payments in proportion to the amount of acreage of national forest land within each county. PILT can be used for any governmental purpose. The 2005 payments from the Forest for all counties are shown in Table 2-44.

Table 2-44. Forest-related PILT Payments to Counties for 2005

County	Payment	% of Total
Barbour County	$16	0%
Grant County	$17,976	2%
Greenbrier County	$154,197	13%
Nicholas County	$36,144	3%
Pendleton County	$76,625	6%
Pocahontas County	$376,270	31%
Preston County	$5,558	0%
Randolph County	$290,565	24%
Tucker County	$144,601	12%
Webster County	$93,834	8%
Totals	**$1,195,786**	**100%**

Source: USDI – www.nbc.gov/pilt/search.cfm

Because these payments are solely based on the amount of federal land within each county, they would not be affected by Forest Plan alternatives, nor would they change by alternative. Based on payments received over the last 20 years, however, it is expected that PILT payments may continue to show modest increases over the next decade under any alternative.

Indicator and Effects for Issue #2

Financial efficiency is measured using Net Present Value, which compares both market and non-market discounted values with discounted operating costs.

Net Present Value (NPV) - This analysis includes both non-market values (economic efficiency) and market prices or revenues. In deriving NPV figures, costs are subtracted from revenues to yield a net value (financial efficiency). “Future values” (i.e., revenues received in the future) are discounted using an appropriate discount rate to obtain a “present value”. The costs used in this analysis are the estimated budget costs for fiscal year 2002.

Table 2-49 displays the economic and financial NPV for each alternative. The reduction of NPV in any alternative as compared to the most financially efficient solution is the economic trade-off, or opportunity cost, of achieving that alternative.

Table 2-49. Economic and Financial Efficiency by Alternative

Alternative	Assigned Values (Economic Efficiency)	Market Price or Value	Market and Non-market Values NPV (Financial Efficiency)
Alternative 1	$1,391,902	$453,373	$1,845,274
Alternative 2	$1,391,902	$428,708	$1,820,609
Alternative 2M	$1,391,902	$423,797	$1,815,699
Alternative 3	$1,391,902	$314,776	$1,706,677
Alternative 4	$1,391,902	$518,541	$1,910,442

Economic efficiency does not change by alternative because the non-market assigned values are the same for all alternatives and they are not expected to change quantifiably by alternative over time. The market value differences are primarily related to timber costs and revenues, which do vary by alternative. When combined together, all alternatives show a net positive value, but all alternatives are fairly close in NPV, with only a 11.9 percent difference between the highest (Alternative 4) and the lowest (Alternative 3).

THE PREFERRED ALTERNATIVE

The Preferred Alternative identified in the FEIS is Alternative 2 Modified (2M). Alternative 2M is essentially Alternative 2, the Preferred Alternative in the DEIS, with minor changes in direct response to public comments on the DEIS and Proposed Revised Forest Plan.

Along with the Responsible Official's discretion, specific decision criteria were used to help choose the Preferred Alternative. These decision criteria were generally tied to the major Need For Change topics in plan revision, and each criterion had a set of representative indicators that were used in the EIS analyses found in Chapter 3. Not all indicators in the EIS were used, as some were duplicative or did not show a clear difference in impacts between alternatives.

> **Criterion 1:** The extent to which the alternative maintains or restores water quality and the soil productivity necessary to support ecological functions in upland, riparian, and aquatic areas.
>
> **Criterion 2:** The extent to which the alternative maintains or restores plant and animal diversity and provides habitats needed to sustain viable populations of native and desired non-native species, including threatened and endangered species, and management indicator species.
>
> **Criterion 3:** The extent to which the alternative maintains or restores forest vegetation to ecological conditions with reduced risk of damage from fires, insects, diseases, and invasive species.
>
> **Criterion 4:** The extent to which the alternative provides settings for a variety of recreation opportunities, including backcountry use within a semi-primitive non-motorized recreation setting.
>
> **Criterion 5:** The extent to which the alternative provides a variety of uses, values, products and services for present and future generations by managing within the capability of sustainable ecosystems.

Alternative 2M is rarely the most effective in addressing the criteria and indicators, but it is never the least effective, and it is the best alternative at consistently addressing the range of criteria and indicators well. In this regard, it is the most consistent and versatile alternative in effectively addressing a wide variety of issues and concerns. Alternative 2M is preferred because, overall, it maximizes the net benefits to the public by addressing their issues and establishing a multiple-use framework for:

- Maintaining or restoring watershed conditions to help provide for water quality, soil productivity, and functioning riparian and aquatic habitats,
- Maintaining, restoring, or enhancing ecological conditions that will help conserve and recover listed species, and that will sustain biological diversity and species viability,
- Increasing the Forest's capability to provide high-quality outdoor recreation opportunities,
- Making timber, energy minerals, special uses, and other valuable commodities available in an environmentally sensitive manner,
- Contributing to the economic and social needs of people, cultures, and local communities by offering sustainable and diverse products, services, settings, and opportunities, and
- Providing clear direction to assist managers in making project level decisions to implement the broader social, economic and ecological goals and objectives of the 2006 Forest Plan.

Alternative 2M is described in detail under the *Alternatives Considered in Detail* section in this Chapter, pages 2-20 to 2-22, and also includes the *Elements Common to All Alternatives* on pages 2-8 through 2-11. The Responsible Official's selected alternative for implementation is documented in the Record of Decision for this FEIS, along with his rationale for the selection.

Chapter 3

Affected Environment and Environmental Effects

Table of Contents

Page No.

Changes to Chapter 3 Between the Draft and Final EIS

All Resource Sections – For each resource section, we added an effects analysis for Alternative 2 Modified that was developed between the Draft and Final. We also updated tables to include more recent information where we had available data.

Air Quality – We added emission factors for helicopter harvest to the effects analysis.

Soil Resource – We added a discussion (Management Implications) in the Cumulative Effects section on the challenges and options for addressing potential cumulative effects from managing on sensitive soils.

Water, Riparian, and Aquatic Resources – We expanded the analysis for aquatic MIS.

Threatened and Endangered Species – We expanded the affected environment descriptions to include more information on the animal species and their habitats. We also expanded the effects sections to provide more detailed analyses that we carried forward into the Biological Assessment.

Timber Supply – In response to comments on the DEIS, we added a Table TR-6 showing timberland in West Virginia by ownership, and we added volume harvested to Table TR-4.

Recreation and Wilderness – In response to comments on the DEIS, we added recent information on the economic impacts of tourism in West Virginia. We explained a discrepancy in MP 5.0 wilderness acres used in the FEIS vs. DEIS. We refined and expanded the ROS analysis to better describe changes expected by Management Prescription area. We added more detailed tables to show differences in MP 6.2 and 8.1 SPNM areas by alternative. We incorporated two new IRAs into the Inventoried Roadless Area analysis.

Road Transportation System – In response to comments on the DEIS, we added as section that compares potential road miles needed for timber harvest, based on harvest area distances from existing roads.

Social and Economic Environment – In response to comments on the DEIS, we revised the county profiles to include more accurate information and added total full-time and part-time employment, and we added State statistics on employment to provide a State-wide context to the economic impacts in the MNF 10-County Region. We also re-ran all of the modeled employment and income outputs by alternative with updated budget and revenue inputs.

Introduction

PURPOSE AND CONTENT

Chapter 3 describes the physical, biological, social, and economic resources of the environment that may be affected by the alternatives presented in Chapter 2, as well as the effects that the alternatives may have on those resources. Affected environment and environmental effects have been combined into one chapter to give the reader a more concise and connected depiction of what the resources are and what may happen to them under the different alternatives. The environmental effects analysis forms the scientific and analytic basis for the comparison of alternatives that appears at the end of Chapter 2.

CHAPTER ORGANIZATION

The remainder of Chapter 3 is organized by resource, focusing on those resources that are related to major issues described in Chapter 1. Each resource section is organized and presented in the format described below. The first three elements of this format define the affected environment, and the last three elements define the environmental consequences.

Affected Environment

Issues and Indicators – This section is divided into three parts for each issue: (1) a brief issue statement, (2) a background section that describes the origin and various aspects of the issue in detail, and (3) the indicators used to measure effects from the alternatives on the issue.

Scope of the Analysis – Briefly describes the geographic area or areas affected for the resource-related issues. Areas may differ for direct, indirect, and cumulative effects. Affected areas may also vary in size depending on the resource, issue, or anticipated activities. This section also describes the time frame over which effects were assessed.

Current Conditions – Describes the current conditions of the resources related to the issues and indicators. This section may also include history, development, past disturbances, natural events, and interactions that have helped shape the current conditions.

Environmental Consequences

Effects Common to All Alternatives – Describes the general type of effects that may occur to the resource from implementation of the alternatives, including any mitigating effects from Resource Protection Methods.

Direct and Indirect Effects – Analyzes the amount and intensity of direct and indirect effects by alternative on the resource-related issues and indicators. Direct effects are caused by an action and occur at the same time and place as that action. Indirect effects are caused by an action but occur later in time or farther removed in distance. This section also looks at the relationship of temporary (0-3 years), short-term (3-10 years), and long-term (>10 years) effects.

Cumulative Effects – Analyzes the cumulative effects to the resource that may result from the incremental impacts of the alternatives when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes the other actions.

ANALYSIS CALCULATIONS

In the modeling and analysis included throughout Chapter 3, the numbers for Management Prescriptions, road miles, acres of timber harvest, etc. are all best estimates based on the latest available information. The modeling and analysis conducted for this EIS are intended and designed to indicate relative differences between the alternatives, rather than to predict absolute amounts of activities, outputs, or effects.

MANAGEMENT PRESCRIPTION BASED ANALYSIS

The Forest Plan and the EIS alternatives do not authorize implementation of management activities described in the effects analyses. The Forest Plan sets the stage for what future management actions are needed to achieve desired outcomes (desired conditions, goals, and objectives), and it provides the sideboards (standards and guidelines) under which future activities will operate in order to manage risks to biophysical resources and the social and economic environments.

To actually implement site-specific projects, project-level planning, environmental analysis, and decisions must occur. For instance, the Forest Plan may contain direction to close or obliterate roads in order to benefit biophysical resources and to increase management efficiency, but a site-specific analysis and decision must be made for each proposal that involves any specific road closures or obliteration. This process is referred to as “staged decision-making” because a second stage of decisions are necessary to carry out projects as site-specific needs, priorities, locations, conditions, and public concerns become evident.

Each EIS alternative provides a different mix of management prescriptions (MPs). The mix of MPs provides an indication of the management goals (i.e., desired outcomes) that subsequent site-specific projects would strive to meet or move toward. Thus, the mix of MPs allocated under each alternative is often used in the EIS effects analyses as a means to differentiate between and compare alternatives. The MP-based effects analyses compare potential effects from various management activities that could occur under various combinations of MPs represented by the alternatives. These effects are modeled based on assumptions about the type, amount, and intensity of management activities that would be allowed or emphasized under each MP. As stated above, the modeled effects in the EIS are designed to show relative differences in alternatives—not to accurately predict the amount or location of management activities that would occur during the planning period should that alternative be selected for implementation.

Air Quality

INTRODUCTION

Federal land management agencies have the unique responsibility to protect the air, land and water under their respective authorities from degradation associated with air pollution emitted outside the borders of Agency lands (Clean Air Act 1990), as well as from the impacts of air pollutants produced within those borders. These mandates are established through a series of legislative and regulatory requirements (Clean Air Act 1990; Organic Act 1977, Wilderness Act 1997). With the burden of these responsibilities, it is important for federal land managers to understand the rules and regulations governing air pollutant emissions and how those air pollutants are impacting Forest resources.

First, the Clean Air Act (CAA) sets the standards for air quality in the United States. The CAA has numerous sections, and among these, three are particularly important to National Forest System (NFS) management: National Ambient Air Quality Standards (NAAQS), the Prevention of Significant Deterioration (PSD) program and the Regional Haze Rule (Visibility Protection CAA Sec. 169a).

The NAAQS set the air quality standards for six criteria pollutants that entire country must comply with. Primary NAAQS standards are set based on human health criteria. It is up to the state air quality regulatory agencies to come up with State Implementation Plans (SIPs) to ensure that these standards are met in their respective states. If the standards are not met for any criteria pollutant, the area is designated as non-attainment for the pollutant. It is the responsibility of the Monongahela National Forest (MNF) to ensure that management activities do not significantly contribute to a violation of the NAAQS.

The Clean Air Act Amendments (CAAA) of 1977 established the prevention of significant deterioration (PSD) program. These amendments designated specific Wildernesses and National Parks as Class I areas. The MNF has two Class I areas; Dolly Sods and Otter Creek Wildernesses. Federally mandated Class I areas are provided with an additional measure of protection under Title I, Part C of the CAAA, which states that one purpose of the Act is "to preserve, protect, and enhance the air quality in national parks, national wildernesses". Further more, the PSD regulations charge the federal land manager with the "affirmative responsibility to protect the air quality related values (including visibility) of any such lands," and to consider "whether a proposed source or modification would have an adverse impact on such values" (40 CFR 51.166 (p)(2)). In light of this responsibility, it is important for federal land managers to be familiar with the status of air quality in and near the Class I areas, as well as how current levels of air pollution are impacting Air Quality Related Values (AQRVs). This information assists federal land managers when making impact determinations about new sources of air pollution.

It is important to note that while the Clean Air Act Amendments of 1977 gave the Forest Service the "affirmative responsibility" to protect Air Quality Related Values (AQRVs) in the Class I areas it manages, that role was limited by Congress to one of *consultation*. This means that the MNF has no direct regulatory authority over sources of air pollution. This authority was given to the United States Environmental Protection Agency (EPA) under the CAA. EPA was given the opportunity to delegate this authority to a respective state agency, which is the case in West Virginia. The MNF consults with state air permitting agencies on PSD and Regional Haze matters through the processes described below.

The permitting agency is required to send a copy of all PSD permit applications and Class I analyses, to the FLM of any Class I area(s) that may be impacted (40 CFR 52.21(p)). The FLM assesses the permit and modeling analyses and, based on this evaluation, determines whether or not the new source of air pollution will adversely impact AQRVs in the Class I area(s) of concern. PSD impact determinations are made on a case-by-case basis, taking into account the geographic extent, intensity, duration, frequency and time of any modeled impacts. The FLM provides the state with this determination as well as any additional concerns or comments. However, the state regulatory agency legally retains the authority to issue a PSD permit. Given that certain requirements are met, the permitting authority can issue a PSD permit regardless of an "adverse impact determination" made by the FLM(s).

While the PSD program was designed to protect Class I areas from new or modified sources of air pollution, the Regional Haze Rule was promulgated to achieve the national "Visibility Protection" goals for Class I areas set forth in section 169 (a) of the CAA. This section of the CAA sets as a national goal: "the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution." The Regional Haze rule requires states to develop long-term strategies for reducing manmade visibility impairing pollutants in 156 federally mandated Class I areas. States must show reasonable progress toward achieving natural visibility conditions in the Class I areas by the year 2064. Because the problem of haze pollution is regional in nature, these reduction strategies are being assessed over large geographic areas through the Regional Planning Organizations (RPOs). Additionally, as part of these reduction strategies, certain existing facilities that emit visibility impairing pollutants at levels that have been demonstrated to cause or contribute to visibility impairment in any Class I area(s) will be subject to applying the Best Available Retrofit Technology (BART). The Forest Service (as well as other FLM agencies) plays a key role in the Regional Haze process, and as such, is currently consulting with states, the EPA and other stakeholders through the RPO process. Forest Service involvement in this process can help to reduce visibility impairment in Dolly Sods and Otter Creek Class I areas.

The authority and responsibility to protect resources within NFS lands is not limited to Class I wildernesses, but requires federal land managers to take the necessary steps to protect all federal lands from air quality impacts; regardless of whether those impacts are coming from within agency borders or without. The CAA of 1990 contains numerous sections dealing with these responsibilities, and Section 101(c) states the primary purpose of the Act:

> "A primary goal of this Act is to encourage or otherwise promote reasonable Federal, State, and local governmental actions, consistent with the provisions of this Act, for pollution prevention" (Clean Air Act 1990).

Beyond the CAA, additional legislation recognizes the importance of air quality and the impact it can have on forest resources. The National Forest Management Act states that Land and Resource Management Plans are, in part, specifically based on:

> "…recognition that the National Forests are ecosystems, and their management for goods and services requires an awareness and consideration of the interrelationships among plants, animals, soil, water, air, and other environmental factors within such ecosystems" (National Forest Management Act 1976).

It is within this regulatory framework that the MNF must strive to protect resources on NFS lands from the detrimental effects of any pollution source. Additionally, it is imperative that while federal land managers work to alleviate harmful effects of air pollution from new and existing sources external to Forest boundaries, they must also continue to be good stewards when conducting management activities that contribute to regional air pollution.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect air quality in and around the Forest.

Background

Although a majority of this area's pollution comes from sources outside the National Forest, activities from within the Forest boundaries can also affect air quality in the region. Activities such as timber harvesting, oil and gas well drilling and operations, road construction or maintenance, and prescribed fire all produce emissions. Additionally, effects of these activities may exacerbate existing air quality related issues (see *Soil Resource* section). However, not all of these activities are expected to change significantly for all alternatives within this planning period. Natural gas exploration and development are expected to remain at current levels, or decrease from existing levels, depending on the alternative. Also, the number of days where road construction or maintenance occurs is not expected to increase over existing levels, and is not a major component of air pollution problems in West Virginia. The remaining two activities, timber harvesting and prescribed fire, are expected to change within the planning period. Particulate matter (PM) and nitrogen oxide (NOx) emissions from these activities will contribute to the total pollution load and are the major pollutants of concern in terms of contributions to NAAQS. Therefore, potential emissions of these pollutants will serve as indicators for air quality effects.

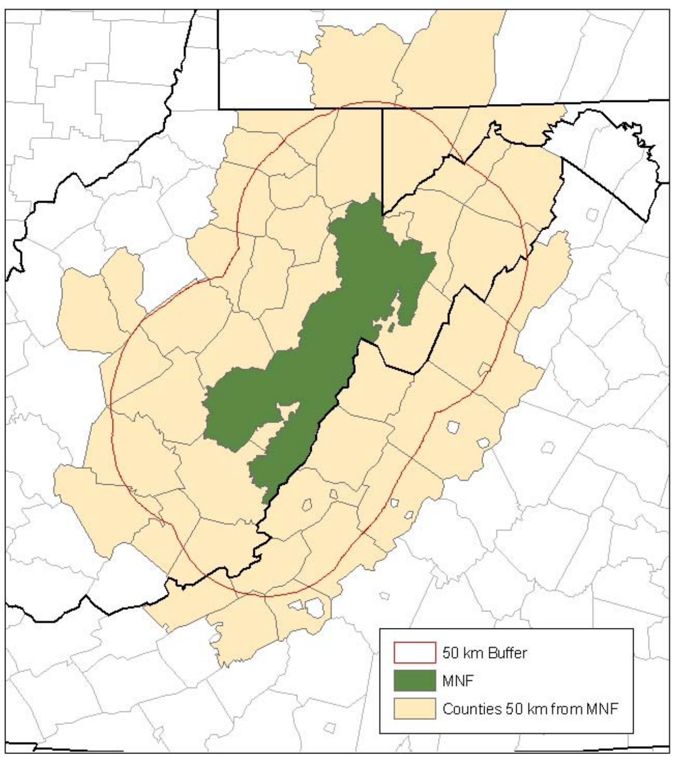
Indicators

Potential emissions of PM and NOx from predicted timber harvest and prescribed fire activities are evaluated and compared to total PM and NOx emissions in counties near the Forest.

Scope of the Analysis

Analyses for direct and indirect effects of air pollution are limited to pollution *emitted* from within lands administered by the MNF as a result of management activities. However, because air pollution disperses beyond political boundaries, levels of pollution emitted from MNF management activities must be evaluated taking into consideration regional pollution loads and current air quality monitoring data. Pollution coming from Forest management activities can impact air quality within Forest boundaries and without. Likewise, pollution from sources outside the Forest boundary affects Forest resources as well as regional air quality. For this reason, air pollution must be evaluated in both a regional and cumulative context; and it is imperative that an area larger than just NFS lands is used in an air quality evaluation. An analysis area with a radius of 50 kilometers from the Forest boundary will be used to describe the effects of emissions from the Forest on regional air quality in this document. This distance was determined to be adequate to describe the area potentially affected by the mobile and area sources of pollution from Forest management activities. Figure AQ-1 shows the analysis area.

Figure AQ-1. Air Quality Analysis Area



CURRENT CONDITIONS

Current air pollution impacts occurring on the MNF are the cumulative result of numerous sources. Pollution from sources such as automobiles, off-road construction equipment, wildland fires, factories, oil refineries and power plants all contribute to the regional pollution load. The

MNF is situated near the industrial heart of the United States. It is within a day's drive of a large percentage of the United States' population, and is downwind of a high concentration of coal-fired electric generating facilities; the leading source of sulfur dioxide (SO_2) and nitrogen oxide (NOx) emissions. This network of coal-fired power plants includes the generally defined "Ohio River Valley". In West Virginia alone, there are 18 existing major coal-fired power plants (US EPA, eGRID data 2003); with several companies seeking to build additional facilities (MNF air specialist, professional knowledge).

When looking at the impacts of air quality on Forest resources, it is important to keep in mind that only a handful of pollutants contribute to a variety of air quality related issues. These pollutants are a concern because of their impacts to both human health and ecosystems, and are described in detail below. Air pollutants are generally classified as either primary or secondary pollutants. Those emitted directly to the atmosphere as products of combustion are classified as primary pollutants, and those formed when primary pollutants undergo atmospheric chemical reactions are secondary pollutants.

Sulfur Dioxide

About 69 percent of SO_2 released to the air (11.2 million tons in 2000), comes from electric utilities, especially those that burn coal (US EPA, Progress Report 2003). Other sources of SO_2 are industrial facilities that derive their products from raw materials—like metallic ore, coal, and crude oil—or that burn coal or oil to produce heat. Examples are petroleum refineries, cement manufacturing, and metal processing facilities. Also, locomotives, heavy marine equipment, and some non-road diesel equipment currently burn high sulfur fuel and release SO_2 in large quantities. Within 300 kilometers of the MNF, there are 311 coal-fired electric generating units (EGUs). Seven of these EGUs are among the top ten highest SO_2 emitting EGUs in the nation[1] (US EPA, eGRID data 2003). Once SO_2 is emitted into the atmosphere, it undergoes chemical transformations to form secondary pollutants such as sulfates and sulfites. In the eastern United States, these secondary sulfur pollutants are the major contributors to visibility impairment and acidic deposition.

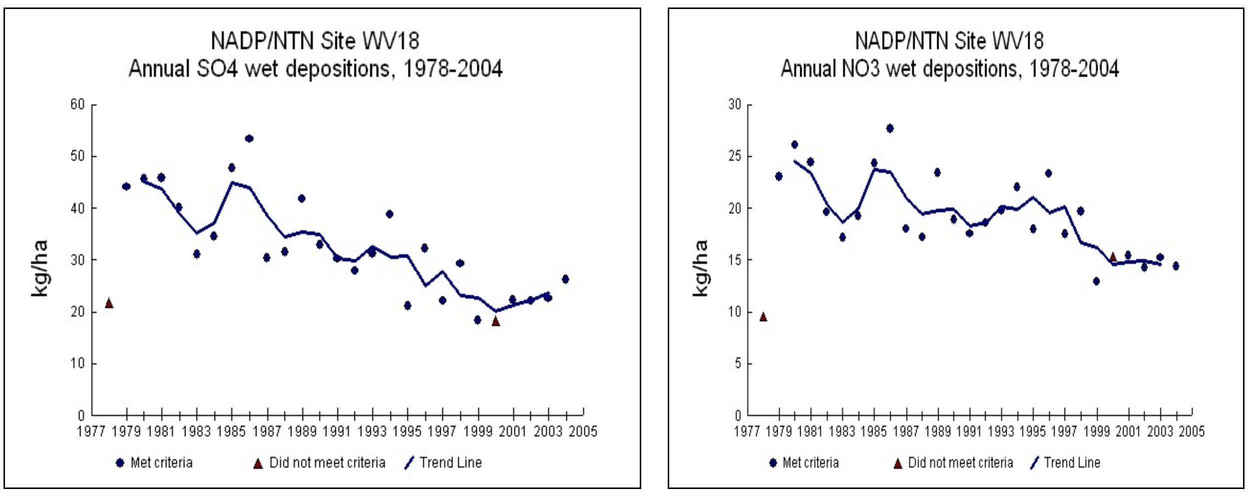
<u>Sulfur Dioxide and Acid Deposition</u>

Acid deposition occurs when acidic sulfur and nitrogen compounds in the atmosphere are deposited on the earth's surface through rain, clouds, snow, fog, or as dry particles. These acidic inputs can contribute to degradation of stream water quality and decrease the amount of available base cations in the soil substrate. An ecosystem's susceptibility to soil nutrient losses and decreases in stream water acid neutralizing capacity (ANC) are influenced by many factors; most notably the bedrock geology/lithology types and the level of acidic inputs. Areas that receive high levels of acidic deposition and have bedrock geology with a naturally low buffering capacity may exhibit nutrient depletion and stream acidification. Stream chemistry data show that streams on the Forest have decreasing ANC values, and there currently is concern that soil nutrient depletion is occurring in sensitive areas (see *Soil Resource* section.) While nitrogen-containing compounds can also result in acidifying effects in ecosystems, sulfates are the dominant contributor in the Eastern US.

[1] Some of these facilities may have made reductions since the time the US EPA eGRID data was compiled.

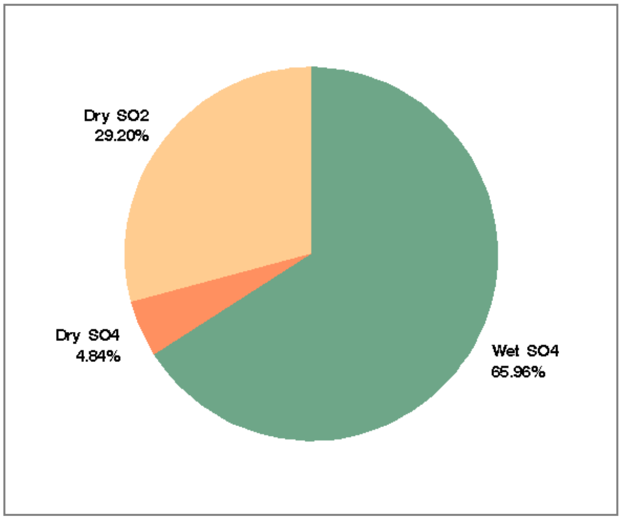
The largest network for monitoring the wet component of acidic deposition is the National Atmospheric Deposition Program (NADP). The NADP monitoring program is a nationwide network that was initiated in 1978 to assess long-term spatial and temporal trends in precipitation chemistry. There are three NADP monitoring sites in West Virginia located in Tucker, Gilmer, and Fayette Counties. The Tucker County site, the closest monitoring site to the MNF, began monitoring precipitation chemistry in 1978 and has the longest data record of the three sites. (Trends in sulfate and nitrate deposition from the Tucker County site are shown in figure AQ-2 below.) The Gilmer and Fayette County sites began monitoring in 1999 and 1983 respectively. Annual wet deposition values from NADP monitoring network show that the MNF, particularly the northern end of the Forest, receives some of the highest sulfate deposition inputs in the country (Estimated Sulfate ion Deposition Rates During 2003; Source, NADP 2003). These observed trends make sense, given the location of the Forest relative to the large upwind network of coal-fired power plants and industries.

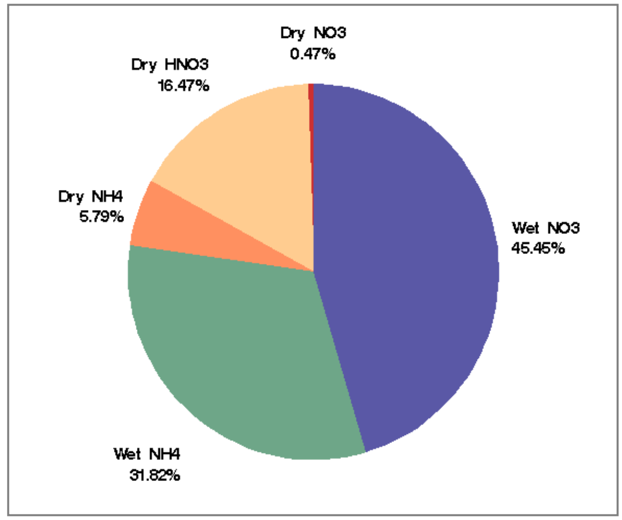
Figure AQ-2. Wet Deposition Trends For Sulfate and Nitrate (kg/ha year^{-1}) at the NADP Monitoring Site in Parsons, Tucker County West Virginia



While the wet component of acidic deposition is important, as previously discussed, precipitation is not the only mechanism by which acidic compounds are deposited on the earth. Acidic compounds are also deposited in dry form as particles or gasses. For this reason, only looking at trends in wet deposition will not show the total acidic loading. The Clean Air Status and Trends Network (CASTNET) monitors concentrations of dry acidic compounds in the ambient atmosphere. These monitored concentrations are then converted to loading values based on estimated deposition flux rates. Figure AQ-3 shows the compositions of the various components of sulfur and nitrogen deposition for 2002-2004 at the CASTNET site in Tucker County, Parsons, WV. (Source: Clean Air Status and Trends Network – CASTNET, 2006.)

Figure AQ-3. Composition of Sulfur and Nitrogen Deposition, Wet versus Dry, for 2002-2004 at the Parsons CASTNET Site





It is important to note that trend analyses for NADP sites show a general decrease in the levels of wet sulfate (SO_4) deposition throughout the nation, especially over the last ten years. Of the West Virginia monitoring sites, this observed trend is most prominent in the data from the Tucker County site. Total annual sulfur deposition on the MNF in the late 1980s ranged from 19 kgha^{-1} at the lower elevations to 26 kgha^{-1} at high elevations (Adams et al. 1991). Few areas of the United States showed higher sulfur deposition. Current monitoring results show that wet sulfate deposition has decreased 29 percent in the mid-Atlantic region. The decline in SO_4 deposition at NADP sites is consistent with the decreases in utility SO_2 emissions brought about by the Acid Rain Program (Title IV) of the 1990 Amendments to the Clean Air Act. The Acid Rain provision mandated significant reductions in SO_2 emissions. The greatest percentage decreases in atmospheric sulfate (SO_4) concentrations occurred in the eastern states north of Tennessee and North Carolina, and the highest absolute decrease (73%) occurred at the Bearden Knob air monitoring station on the MNF (often referred to as Dolly Sods in the literature) (Malm et al. 2002). These reductions are attributable to large reductions in SO_2 emission at sources upwind from the MNF between 1990 and 1999: Indiana, -44%; Ohio, -35%; West Virginia, -34%; Kentucky, -29%; and Illinois, -13%. In these five states, SO_2 emissions decreased by 2.5 million tons between 1990 and 1999. Trends in nitrate deposition do not show as obvious or dramatic reductions as those for sulfate.

Downward trends in SO_2 emissions and SO_4 deposition are predicted to have a positive effect on aquatic and soil resources on the MNF; however in many streams the reductions are not great enough to reverse all of the degradation that has already taken place. For example, a number of streams on the Forest have been acidified to the point where they are no longer capable of sustaining aquatic life or have acidified to where only the most tolerant aquatic species remain. According to modeling projections (SAMI 2002, Sullivan and Cosby 2004), which take into account historic deposition rates, reductions in SO_2 emissions resulting from the 1990 Clean Air Act amendments will not be enough to restore the chemistry in many of these sensitive and acidified streams to levels where aquatic life can thrive, even after 100 years. Significant additional emission reductions will be needed to restore already degraded streams, and to protect streams that have not yet degraded significantly.

Critical Loads and Acid Deposition

A critical load is a quantified estimate of *pollutant exposure or loading* below which harmful effects to environmental receptors do not occur. A critical load can be developed for a variety of pollutants and receptors within a particular ecosystem. It is a scientific number based on modeled or measured dose-response data. Given the current pollution loadings or exposures and the sensitivity of the receptors in an area, this number may or may not be exceeded. Receptors or indicators chosen for a critical load can be aquatic or terrestrial ecosystem components, and indicator measures can be either biological or physical parameters of those ecosystem components.

Because the critical load(s) may or may not have been exceeded, target loads are selected to reflect policy or management goals, using scientific information along with social, economic, spatial and temporal considerations. "Federal area managers are beginning to use critical loads as tools for quantifying harmful pollution levels and setting goals for resource protection or restoration on federal lands" (Porter et al. 2005). Using this definition, target loads would be set for areas on the Monongahela based on the critical load(s) and the current levels of deposition in the area. Land management goals may be a factor that assists the MNF in choosing the target load, but because this is a pollutant exposure or loading, it would not be chosen to reflect management decisions, but rather to reflect air quality goals.

A critical load could be used when assessing how certain management activities may exacerbate air pollution related problems in certain sensitive areas, or to identify areas where mitigations may be an option for resources that have been negatively affected, but neither the critical nor target load determinations would be driven by these activities. Additionally, critical and target loads will help the Forest define the effects of acidic deposition from new and existing pollution sources on aquatic and terrestrial ecosystems as we continue to work with state and federal air quality regulators to reduce regional levels of deposition. This is potentially the most beneficial application of critical and target loads, because it will assist the MNF in demonstrating to air regulators the level of pollution reductions needed to restore or maintain ecosystems of concern. Currently, the types of data needed to calculate critical loads are being collected to determine these values for the MNF.

Sulfur Dioxide and Regional Haze

During the last four decades, the eastern United States has seen a significant regional reduction in visibility, brought on by a corresponding increase in ambient levels of visibility-impairing pollutants often referred to as fine particulates (Malm 1999). The estimated natural background visibility for the eastern United States is 93±28 miles (NAPAP 1990), but average annual visibility at Dolly Sods and Otter Creek Wildernesses is now only 40 miles (VIEWS 2003). This degradation of visibility, both in terms of how far one can see and the clarity of the view is called regional haze. Although many fine particulate components such as elemental and organic carbon and nitrates contribute to visibility impairment, the major visibility-impairing pollutant in the eastern United States again is sulfate; which comprises most of the measured fine particle mass (IMPROVE Data 2003). Furthermore, sulfate particles are considered hygroscopic, which means their effectiveness in impairing visibility is magnified with increasing relative humidity. A humid atmosphere alone does not result in visibility reductions, but sulfate particles grow in size when they attach to atmospheric water molecules; a size that is more effective at scattering the sun's light (Malm 1999). About 60 percent of SO_2 emitted nationally comes from coal-fired power plants (US EPA, National Air Quality and Emissions Trends Report Data 2003). Organics (released primarily from vegetation as volatile organic compounds (VOCs) are the second most important fine particles measured.

The Inter-agency Monitoring of Protected Visual Environments (IMPROVE), a national network of particulate monitors established for the protection of Class I wilderness areas, has monitored the constituents of regional haze for more than two decades. The IMPROVE monitor located closest to the MNF is at Bearden Knob near Dolly Sods Class I area. IMPROVE data from the Bearden Knob monitoring site were used in the visibility description that follows.

The clearest days at Dolly Sods have the lowest fine particle mass (3.4 ug/m3), with estimated visibility at 78 miles (using the annual average relative humidity of 82 percent). Sulfates comprise approximately 56 percent of the total fine particulate mass on these low mass days. On the highest mass (18.2 ug/m3) days, the visibility is reduced significantly to 15 miles (IMPROVE Data 2003). Sulfates comprise 85 percent of the total fine particulate mass on these high mass days. The days with the poorest visibility are most likely to occur May through September (Air Resource Specialists 1995), the time of year when the Forest sees the most visitor use. Throughout the year, people are most likely to see a uniform haze, like a white or gray veil, that obscures the scenery (Air Resource Specialists 1995). Trend plots from the IMPROVE monitoring site at Bearden Knob show that for the 20 percent worst visibility days, the extinction values are decreasing and visibility is improving (Figure AQ-2). The 20 percent best visibility days are not showing similar improvements (http://vista.cira.colostate.edu/views/) (Figure AQ-3). However, the Regional Haze Rule, a regulation aimed at reducing haze forming pollutants in federally mandated Class I areas, is concerned mainly with improvements on the worst visibility days, and maintaining visibility on the best days. The trend plots below show visibility data measured in inverse megameters; a low measurement constitutes minimal light extinction and thus a good visibility day, a high measurement constitutes high light extinction and thus a poor visibility day.

A recent study assessed the spatial and temporal trends of sulfates monitored by the IMPROVE network over the last 10 years. The results show that the greatest statistically significant percent reduction in sulfates in the eastern United States, a reduction of 73%, occurred at Dolly Sods Wilderness (Malm et al. 2002). Again, this reduction in monitored sulfate levels is most likely attributable to recent reductions in sulfur dioxide emissions from implementation of the acid rain program. However, despite these reductions in visibility impairing pollutants, levels of these pollutants still exceed natural background conditions, and visibility is still impaired.

Figure AQ-4. Light Extinction Monitored at Dolly Sods on the 20% Worst Days - IMPROVE

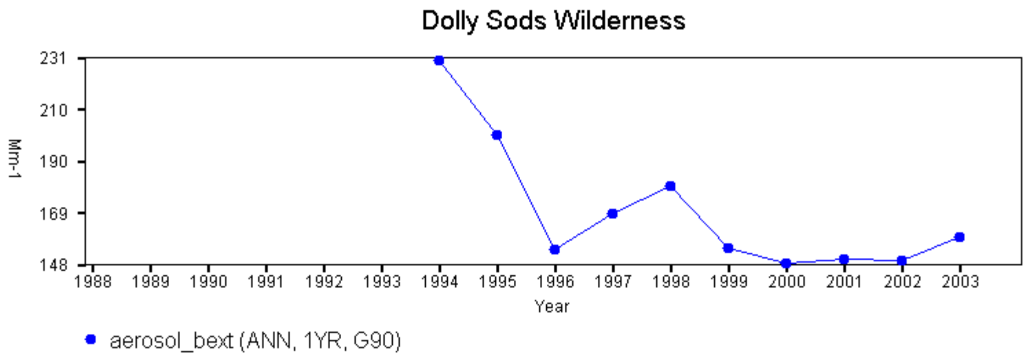
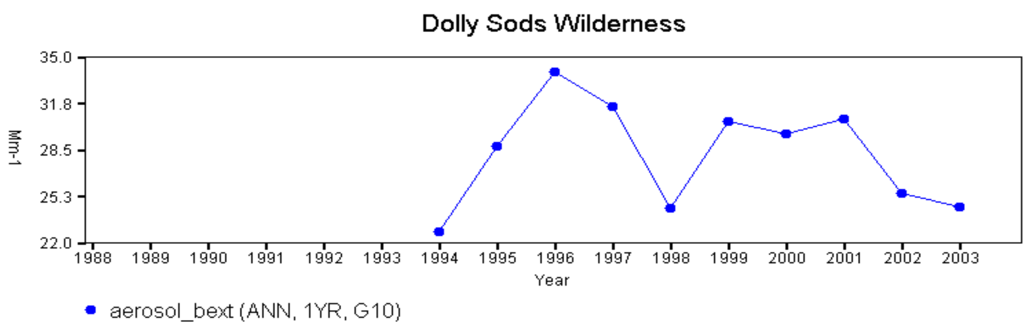


Figure AQ-5. Light Extinction Monitored at Dolly Sods on the 20% Best Days - IMPROVE



Nitrogen Oxides

More than 95 percent of nitrogen oxides or NOx emissions are in the form of nitric oxide. The primary source of NOx emissions is the transportation sector. Point sources such as coal-burning electric generation facilities also contribute ambient NOx levels. Smoke from wild and prescribed fire is also a contributor to NOx production, and is a concern for federal land managers. However it should be noted that thermal NOx production increases with increased burn temperature. Relatively low-temperature prescribed burns emit very little NOx as compared to wildfires. When trapped in sufficient quantities, nitrogen dioxide can be seen as a brownish haze. Secondary pollutants formed from nitrogen oxides such as nitrates also reduce visibility and contribute to acid deposition (discussed in the Visibility and Acidic Deposition sections above). In the presence of VOCs and sunlight, nitrogen oxides rapidly contribute to the formation of ozone. Available evidence suggests that nitrogen oxides are a controlling factor in the formation of ground-level ozone in rural areas of the Southern United States (Chameides and Cowling, 1995).

Ozone

As stated above, ground level ozone (O_3) is a secondary pollutant, and its production is highly dependent on the presence of nitrogen oxides and VOCs in the right ratios, sunshine, and elevated temperatures. Therefore, high ozone levels will occur only during periods of warm weather, plentiful sunshine, and high levels of ozone-forming pollutants. For this reason, the ozone monitoring season extends from April to October. It is important to note that there are two locations in the atmosphere where ozone occurs; the stratosphere (upper atmosphere) and the troposphere (ground level). Although the presence of ozone in the upper atmosphere is highly beneficial, in sufficient doses at ground level, ozone is considered a free radical; capable of killing living tissue in plants and in the human lung. Ozone's harmful effects are due to the pollutant's chemical make-up. The compound ozone is composed of three oxygen molecules, and is less stable than diatomic oxygen (the oxygen our bodies need). This unstable molecule reacts with the tissues inside the leaf of a plant, sometimes causing the death of those tissues. This same ozone radical also reacts with tissues in the human lung, causing inflammation and respiratory ailments, and in extreme cases premature death. The NAAQS standard for ozone is set at levels considered protective of human health; however damage to plants occurs at levels below the NAAQS standard for ozone. The ozone standard for human health is set at .085 parts per million (ppm) for a rolling 8-hour average, but injury to plants is common at levels below the standard.

The .085 8-hour standard for ozone is a new standard, which was promulgated in July of 1997 (CAAA sec 50.10). Attainment of the ozone NAAQS is based upon a three-year average of the 4^{th} highest daily 8-hour running average. Areas that have an EPA Federal Reference Method (FRM) ozone monitoring site must meet these criteria; otherwise the area is designated non-attainment for ozone. However, areas that do not have a FRM ozone monitoring site are designated as unclassifiable. Therefore, statewide attainment of the NAAQS is sometimes only as certain as the extent of the monitoring network. There are eight FRM ozone monitoring sites in eight different counties in West Virginia, which are operated by the West Virginia Department of Environmental Protection (WVDEP). Most of these lie in metropolitan areas. Of these eight counties, only one, Greenbrier County, contains NFS lands. Averaged data from the 2001 through 2003 monitoring seasons show that this site is just below the NAAQS, at .080 ppm. Of the remaining seven FRM ozone monitoring sites, six are exceeding the standard and one is just below it for the 2001 through 2003 monitoring season.

There are two additional ozone monitoring sites in West Virginia that are not part of the state's network. These sites are operated by the USDA Forest Service Northeastern Research Station in Parsons, West Virginia. One is part of the Clean Air Status and Trends Network (CASNET) rural area monitoring network and is located in the Nursery Bottom near the research station (1673 ft elevation). The other is located at a higher elevation site, Bearden Knob (3855 ft elevation), outside of Davis, WV. Although neither site is used to determine attainment of the NAAQS, a recent review of the monitoring data from Bearden Knob shows that the NAAQS were exceeded (based on the attainment criteria described above) from 1995-1999. More recent data from 2000-2003 show that the NAAQS have not been exceeded, but levels remain just below the standard.

Ozone effects to vegetation are highly variable and are dependent on factors such as the sensitivity of a given species, the magnitude and duration of ozone exposure and climatic factors. In terms of vegetation exposures, continuous moderate-to-high ozone exposures are sometimes of greater biological significance than very high concentration exposures for a short period of time, depending on the magnitude of the concentrations. Consequently, vegetation effects can be observed even at moderate ozone exposures. Additionally, ozone exposures at high elevation sites can often be greater than those for low elevations sites because these sites to not exhibit the diurnal fluctuations of high concentrations during the daytime hours and low ozone concentrations during the night as is observed at the lower elevation sites. This pattern is reflected through a comparison of the data from the high elevation Bearden Knob monitoring site and the low elevation Nursery Bottom site; ozone concentrations at Bearden Knob show relatively little (or a flat) diurnal variation, while those at the Nursery Bottom are variable throughout the day, with the greatest differences occurring between the midday and nighttime hours (Lefohn et al. 1994). Ozone exposures at levels sufficient to cause foliar injury in sensitive species have been recorded at these sites (Edwards et al. 1991; Lefohn et al. 1994), and some ozone symptoms on foliage have been observed in Otter Creek (Jackson et al. 1992).

While foliar ozone symptoms have been observed in Otter Creek, widespread injury is not apparent. Despite the record of ozone concentrations at levels indicative of vegetation injury, plants to not always exhibit the predictive response. This is in part due to climatic factors which influence plant stomatal functions. Generally speaking, vegetation response to ozone increases with increasing exposures, however this response is only apparent during periods of adequate moisture and nutrient availability; during periods of moderate to extreme drought, stomata closure increases, and thus the amount of ozone that enters the leaf decreases. Because of this, predicted vegetation responses to ozone levels should be evaluated in the context of concurrent climatic conditions. Taking these factors into account, a recent study (Edwards et al. 2004) evaluated the response of vegetation on the MNF to ozone for the years 1988 through 1999. Vegetation response was predicted using a combination of two metrics; the W126 values (sigmoidally weighted exposure index), and the number of hours that average concentrations were greater than or equal to 0.10 ppm (N100) at monitoring sites near the MNF. These metrics were then assessed in the context of the Palmer drought index for the given year and location of monitored ozone data. The results of this comparison showed minimal ozone effects, or effects only to highly sensitive tree species, with the exception of 1988. However when these predicted vegetation effects were evaluated along with the average Palmer drought index conditions for 1988, it was found that West Virginia experienced severe drought that year, and as a result substantial ozone damage would have been unlikely. To further support this finding, the authors reviewed ozone injury surveys conducted in Dolly Sods and Otter Creek Wildernesses for the years of concern. They found that in 1988 observed ozone symptoms were less frequent than those in 1989-1990 under near normal precipitation conditions (Edwards et al. 2004).

Particulate Matter

Particulate matter (PM) refers to any suspended atmospheric particle and is comprised of many different elements or compounds. It is defined based on various size classes of the particle's aerodynamic diameter, i.e. particles with an aerodynamic diameter of 10 microns are referred to as PM_{10} and particles with an aerodynamic diameter of 2.5 microns are referred to as $PM_{2.5}$. PM can be either a primary or a secondary pollutant, both of which affect Forest resources. Primary particulates tend to be larger in size, and are directly emitted from a combination of sources including combustion sources, agriculture, and road construction. Secondary fine particles are formed when combustion gases are chemically transformed into particles. The bulk of regional fine particles within the analysis area are the result of these chemically transformed combustion gases, such as sulfates and nitrates; mainly sulfate particles (transformed SO_2) from coal-fired power plants. These smaller, chemically transformed fine particles are largely responsible for regional haze.

While sources of PM outside of the Forest have a major impact on air quality, Forest Service activities also can affect air quality. Smoke emitted from forest fires, both prescribed and wild, is a major concern in terms of Forest activities that have the potential to affect air quality. Soot particles from wildland fires are a small, but significant part of the total $PM_{2.5}$ load. The 2006 Forest Plan prescribes smoke management standards and guidelines that would minimize the impacts of smoke from prescribed burning on smoke-sensitive sites.

There are NAAQS standards for two size classes of fine particulates, one for PM_{10} and $PM_{2.5}$. The $PM_{2.5}$ standard is newer and more stringent, and is the standard of concern, since particles with a diameter of 2.5 microns or less have a greater ability to impair visibility and impact human health. The NAAQS standard for $PM_{2.5}$ is a 24-hour average of no greater than 65 micrograms/m^3, or an annual arithmetic mean of no more than 15 micrograms/m^3. Currently there are no areas near the Forest that have been designated as non-attainment for fine particulate matter, however there are also no monitoring sites in counties containing or adjacent to NFS lands. There are 14 counties in West Virginia that have a FRM $PM_{2.5}$ monitoring site, and out of these 14, 9 are exceeding the annual standard.

Summary

Air quality data are collected for various pollutants in areas around the Forest. We have found that regional sources of air pollution are having an adverse affect on Forest resources. Visibility in the East has been reduced from a natural background range of 90 to 130 kilometers to an average visual range of 30 to 40 kilometers. Acid deposition is having a negative impact on West Virginia's aquatic ecosystems, and many of the Forest's trout streams are classified as moderately to highly acid sensitive. Additionally, current data suggest that soil nutrient losses may be occurring in sensitive soils on the Forest due to historical and current high acidic deposition levels combined with low buffering capacity of sensitive sites (see *Soil Resource* section). Ozone injury, though not widespread, has been documented on the foliage of ozone-sensitive species, such as black cherry and blackberry, in the Otter Creek Wilderness. Given these adverse impacts currently occurring on the National Forest, air quality in the region cannot be labeled as good.

ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Prescribed fire is the main management activity on the Forest that can affect local and regional air quality. However, the current National Fire Plan and the Healthy Forest Initiative both direct the Forest Service to utilize prescribed fire more frequently. Despite potential air quality effects from prescribed fire, it can provide important and necessary ecological benefits in forested landscapes. EPA recognized these ecological benefits and developed the Interim Air Quality Policy on Wildland and Prescribed Fires (US EPA 1998) in an effort to help states implement smoke management programs in cooperation with federal and other land management agencies. This policy provides incentive and guidance to states for developing smoke management programs for dealing with the NAAQS and emissions from prescribed fires, while allowing burning programs to continue. Currently, there are no major wildland burning programs in West Virginia relative to other states, and WVDEP has not developed a smoke management program. However, they may do so in the future, particularly if state-wide prescribed burning programs increase. If the state chooses to develop a smoke management program, it is crucial for the Forest to be involved. In the meantime, however, there are smoke management techniques that the Forest can and should utilize to protect smoke sensitive areas and public welfare, and to meet the NAAQS. Revised Forest-wide management direction states that the Forest will use best available smoke management techniques.

Section 176 (c) of the CAA prohibits Federal agencies from engaging in or supporting any activity that does not conform to a State's Implementation Plan to bring an area back into attainment. As stated previously, there are currently no counties that contain or are adjacent to MNF lands that are in non-attainment status. Greenbrier County near the southern end of the Forest is the only county that contains MNF lands and has a FRM NAAQS ozone monitor. Ozone data from this monitor shows that the area is just below the standard, and it should be identified as a smoke sensitive area.

Effects Common to All Alternatives

An additional alternative, Alternative 2 Modified, was generated between the draft and final stages of the Forest Plan Revision. The only change under Alternative 2 Modified that affects the air quality analysis is the ASQ estimate, which impacts the estimated amount of emissions produced during timber harvest emissions. Prescribed fire activity will be the same under Alternative 2 Modified as under Alternative 2. The air quality effects under Alternative 2 Modified have been added to the emissions tables below.

The level of prescribed fire use is expected to increase under Alternatives 2 and 4, the Need for Change and Vegetation Restoration alternatives, respectively. However, the level of increase varies between these alternatives. The level of prescribed fire use is expected to remain at current levels under Alternatives 1 and 3, the No Action and Backcountry Recreation alternatives, respectively. Despite the varying levels of prescribed fire usage, all wildland fires result in pollutant emissions, which can impact air quality on and off the Forest. Fine particulate is the major pollutant of concern emitted from prescribed fires and is also a criteria pollutant regulated under the CAA. As described previously, fine particulates are a concern in terms of human health and visibility impairment. Prescribed fires also to a lesser extent emit nitrogen oxides, which are precursors to ozone formation and are regulated as a surrogate for ozone. Though both VOCs and NOx contribute to ozone formation, NOx is the limiting factor in ozone production. Because of this, NOx emissions from prescribed fires will be assessed in this analysis in addition to PM emissions. Again, it needs to be stressed that thermal NOx production increases with increased burn temperature. Relatively low-temperature prescribed fires emit very little NOx as compared to wildfires. Prescribed fire situations provide land management agencies with the opportunity to minimize the impacts of smoke on local communities, while a wildfire situation does not typically afford such an opportunity.

To a lesser extent, emissions from equipment used during timber harvest operations also contribute to the total pollution load. Emissions from harvesting equipment include NOx, particulate matter, and hydrocarbons; all of which are criteria pollutants. Although other types of management activities can result in pollutant emissions, timber production is the only other activity that is predicted to change within the next planning period. It is therefore the only other management activity that will analyzed for air quality effects.

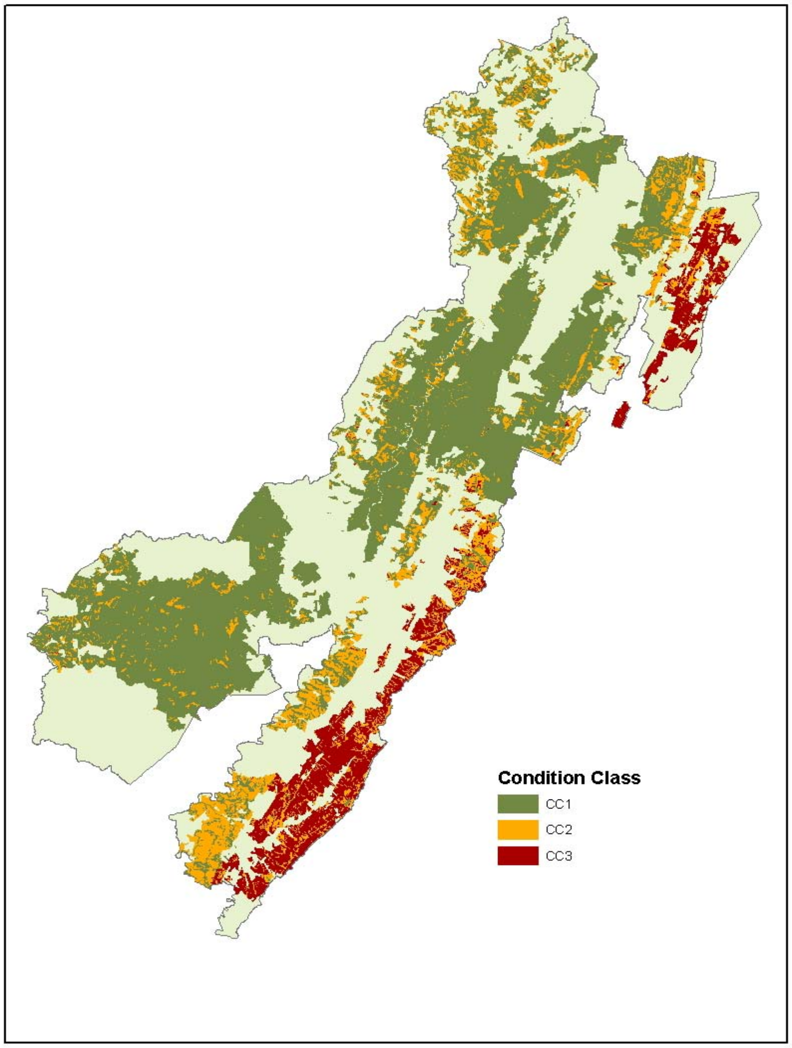
Direct and Indirect Effects by Alternative

Different methods were used in this assessment to derive emission estimates for prescribed fire and timber harvest activities. However, similar methods were used to interpret air quality impacts resulting from the predicted emissions. These analyses and the results by alternative are described below.

Prescribed Fire Emissions

Because prescribed fire activity on the MNF has been minimal in the past, the need to increase the number of acres treated with prescribed fire is understood, but site-specific burn units have not been identified within the scope of this large-scale assessment. The areas on the Forest that are most suitable for, and in the most need of prescribed fire treatments were identified based on best estimates of the fire regimes for the Forest landscape and current Condition Classes of these fire regimes, given the historic fire activity. Figure AQ-4 shows the estimated Condition Classes on the Forest.

Figure AQ-6. Best Estimates of Fire Condition Classes on the MNF



Areas in Condition Class 3 are considered to be the furthest from the natural fire cycle for that area, while those in Condition Class 1 are more or less within the natural cycle. However, the role of fire in the development of eastern forests before European settlement is still being investigated and is not well known for West Virginia and the Monongahela. The ecological role of fire in regeneration of oaks is better documented, and silvicultural systems including prescribed fire have been developed (for example: Schuler and McClain 2003; Brose et al. 2001; and Sutherland 1997). So it must be stressed that prescribed fire usage predictions per alternative are a best estimate that could change in the future as more information on condition class and natural fire cycles for this region becomes available.

Locations of areas in Condition Classes 2 and 3 demonstrate that the eastern and southern portions of the Forest, which lie in the Northern Ridge and Valley section of the Forest, are both more fire dependent, and further from their natural fire cycles. This makes sense because this section of the Forest lies in the rain shadow of the Allegheny Mountains, and tends to be dryer than other sections of the Forest. It is also where oak regeneration is a goal. Prescribed fire activities will be concentrated in the areas that are in Condition Classes 2 and 3.

Management prescriptions were assessed in conjunction with the condition class categories to determine the relative number of acres suitable for prescribed burning within each alternative based on its management emphasis. Using this number, an estimate of potentially treatable acres was developed for each alternative.

Emissions estimates per acre burned in each alternative were derived using the First Order Fire Effects Model (FOFEM, Version 5.00; Rocky Mountain Research Station). This emissions estimate was then multiplied by the number of acres that would be burned each year in each alternative to get an annual emissions estimate. To assess air quality effects, these annual emissions estimates from prescribed fire have been compared to regional annual emissions (all counties within 50 kilometers of the MNF) in tons per year. It is important to note that the number of acres treated with prescribed fire annually is highly dependent on weather and climatic conditions among other local factors. Because there is no way to predict where and when individual prescribed burns will occur, this analysis broadly assumes that the same number of acres will be treated with prescribed fire annually at the maximum level for each alternative. In reality, there would likely be some years with little prescribed fire activity, while others may be much closer to the maximum annual estimate.

The regional emissions data were obtained from the most recent and accurate emissions database available. Currently, this is the 2002 VISTAS base case emissions database. It can be assumed that if predicted emissions from the proposed prescribed fire activities contribute a small enough percentage to the total pollution load, they would not impact attainment of the NAAQS. Most counties within 50 kilometers of the MNF are either in attainment or unclassifiable status. (The exception is Marion County to the North of the MNF; only a portion of the county is within 50 kilometers of the MNF. Marion County is currently exceeding the annual $PM_{2.5}$ standard). A percentage threshold of 5 percent[2] has been chosen for the emissions comparison. If emissions from prescribed fire activities do not exceed 5 percent of the total pollution load in the region, they will be considered below our level of concern.

Because site-specific burn units have not been identified within the scope of this large-scale assessment, fuel loading characteristics are unknown at this time. For this reason a range of fuel loading characteristics that were deemed representative of portions of the Forest with potentially treatable acres were used in the emissions analysis. Fuel loading characteristics for more mesic sites with mixed oak and hardwood species were modeled to represent the treatable acres on the western side of the Forest, and fuel loading characteristics for dryer mixed oak and chestnut oak sites were modeled to represent the eastern sites. The range of potential emissions from the various fuel loading characteristics and their effects on air quality are presented in Table AQ-1.

[2] The threshold of 5% was chosen to be very conservative in protecting air quality. Air regulations often include a 5% change as a significance threshold for more rigorous or refined air quality analyses. Though we are more concerned with Forest emissions on the NAAQS, this threshold seemed appropriate for this analysis because PSD increments represent a percentage of the total NAAQS. Also, this percentage is significantly less than the percentage that conformity thresholds comprise of the total NAAQS for NO_x and PM_{10}.

Alternative Comparison - Emission estimates per acre burned were derived from the FOFEM model. The number of acres burned varied by alternative, and thus the prescribed fire annual emissions also varied. Under Alternatives 1 and 3, maximum prescribed fire usage is expected to remain at current levels, which is 300 acres treated per year. Under Alternative 2 and Alternative 2 Modified, prescribed fire usage would increase to a maximum 3,000 acres per year. Under Alternative 4, prescribed fire usage would increase to a maximum 7,500 acres per year. The results for each alternative are presented in Table AQ-1.

Table AQ-1. Fire Emissions from Predicted Prescribed Fire on the MNF

Alternative	Pollutant	Rx Fire Emissions (Tons per Year)	Total Regional Emissions (Tons per year)	Percent Rx Fire of Total Regional Emissions
Alternative 1 300 Acres Treated	**PM 10**	12.2 – 22.7	122,957	0.01% – 0.02%
	PM 2.5	10.4 – 19.4	38,968	0.03% – 0.05%
	NOx	2.0 – 5.7	212,477	0.001% – 0.003%
Alternative 2 3,000 Acres Treated	**PM 10**	121.5 – 226.5	122,957	0.10% – 0.18%
	PM 2.5	103.5 – 193.5	38,968	0.27% – 0.50%
	NOx	19.5 – 57	212,477	0.01% – 0.03%
Alternative 2M 3,000 Acres Treated	**PM 10**	121.5 – 226.5	122,957	0.10% – 0.18%
	PM 2.5	103.5 – 193.5	38,968	0.27% – 0.50%
	NOx	19.5 – 57	212,477	0.01% – 0.03%
Alternative 3 300 Acres Treated	**PM 10**	12.2 – 22.7	122,957	0.01% – 0.02%
	PM 2.5	10.4 – 19.4	38,968	0.03% – 0.05%
	NOx	2.0 – 5.7	212,477	0.001% – 0.003%
Alternative 4 7,500 Acres Treated	**PM 10**	303.8 – 566.3	122,957	0.25% – 0.46%
	PM 2.5	258.8 – 483.8	38,968	0.66% – 1.24%
	NOx	48.8 – 142.5	212,477	0.02% – 0.07%

Annual emission estimates from prescribed fire activity in all alternatives are well below the regional pollution contribution threshold of 5 percent and therefore are not a major concern. This however does not preclude the Forest from using the best available smoke management techniques and technology to alleviate nuisance or human health impacts of smoke in local communities and smoke sensitive areas, or from avoiding impacting attainment status for any criteria pollutant in areas where burns are conducted.

Timber Harvest Emissions

Rough emissions estimates were made using some basic assumptions that have been developed for typical timber harvests in mountainous areas, such as the types of equipment that are likely to be used, the number of hours a day this equipment would be operating, and how many days out of the year this will occur based on the total volume of timber removed. Using these assumptions, an estimate of the hours of operation for each piece of equipment was derived and this was multiplied by an emissions factor (in pounds per hour) for each type of equipment. Emission factors used were developed by the Environmental Protection Agency (EPA)[3]. These emissions were then converted to tons per year for comparison to regional emissions.

Between the draft and final version of this analysis, a method for estimating emissions from helicopters during helicopter yarding operations was developed. Emission factors for helicopter engines were taken from EPA's Procedures for Emission Inventory Preparation Volume IV (EPA, 1992). As with emission estimates for conventional harvest operations, basic assumptions were made to determine the average hours of operation for the helicopter in the varying range of flight modes, as well as other associated equipment used at the site during a typical helicopter yarding operation. These estimates were multiplied by the EPA emission factors to get the total annualized emissions estimates for each alternative. In this FEIS, the estimates of total emissions generated by timber harvest activities under each alternative reflect the updated information for helicopter yarding; in the calculations, harvest operations were broken out by harvesting method and emissions were estimated for each using the appropriate emission factors and then combined to get the total emissions estimate. Therefore, emission estimates reported in this version of the EIS will vary from those reported in the draft version.

Because the exact timing of harvesting activities can not be predicted within the scope of this large-scale assessment, the estimates are based on the total volume removed in each alternative, which was apportioned equally over the ten-year planning period for which harvest activities are expected to occur. For example, the total volume of timber that could be removed in each alternative was divided by 10, to get an annual estimate of timber harvested each year.

As in the prescribed fire analysis, emissions from timber harvest activities were interpreted in the context of the regional pollution load. The estimated annual emissions were compared to total annual emissions from all counties within 50 kilometers of the Forest. Again, the emissions data for the analysis area were obtained from the 2002 VISTAS base case emissions database, and the 5 percent of total region emissions threshold was used for the comparison.

Alternative Comparison - Table AQ-2 shows that annual emission estimates from timber harvest activities in all alternatives are well below the regional pollution contribution threshold of 5 percent and therefore are not a major concern.

[3] EPA420-F-97-014 - Emission Standards Reference Guide for Heavy-Duty & Nonroad Engines, September 1997, EPA420-R-979-009 - Exhaust Emission Factors for Nonroad Engine Modeling - Spark Ignition, Feb. 24, 1998, Revised March 30, 1999, EPA420-P-02-016- Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression Ignition, November 2002

Table AQ-2. Emissions from Timber Harvest on the MNF

Alternative	Pollutant	Timber Harvest Related Emissions (Tons per Year)	Total Regional Emissions (Tons per year)	Percent Timber Harvest of Total Regional Emissions
Alternative 1	**VOC**	110.8	118,251	0.094%
	NO_x	85.5	212,477	0.040%
	PM	5.1	161,925	0.003%
Alternative 2	**VOC**	110.2	118,251	0.093%
	NO_x	84.1	212,477	0.040%
	PM	5.05	161,925	0.003%
Alternative 2 Modified	**VOC**	109.7	118,251	0.093%
	NO_x	83.7	212,477	0.039%
	PM	5.03	161,925	0.003%
Alternative 3	**VOC**	87.4	118,251	0.074%
	NO_x	66.5	212,477	0.031%
	PM	3.99	161,925	0.003%
Alternative 4	**VOC**	115.2	118,251	0.097%
	NO_x	87.3	212,477	0.041%
	PM	5.2	161,925	0.003%

*Emissions estimates are based on an estimated annual average ASQ (CCF) over the life of the plan. This is a conservative estimate, as the actual volume of timber removed will likely be less than the ASQ.

Cumulative Effects

Cumulative effects of air pollution from Forest management activities were assessed using the combined effect of prescribed fire and timber harvest emissions by alternative. These results are in Table AQ-3. The cumulative effects were derived using the upper range of emissions from prescribed fire activity based on fuel loadings. Also particulate matter was broken out into the $PM_{2.5}$ and PM_{10} size classes for the prescribed fire analysis; these values were summed with the timber harvest particulate estimates, to get the cumulative estimate.

Given that the both prescribed fire and timber harvest emissions comprise such a small percentage of the regional pollution load, the cumulative effects of these Forest management emissions are still below the 5 percent emissions threshold and are therefore not a major concern.

Table AQ-3. Cumulative Emission Estimates for Management Activities on the MNF

Alternative	Pollutant	MNF Total Management Emissions (Tons per Year)	Total Regional Emissions (Tons per year)	Percent MNF Management Activities of Total Regional Emissions
Alternative 1	**VOC**	110.8	118,251	0.09%
	NO_x	91.2	212,477	0.04%
	PM	47.2	161,925	0.03%
Alternative 2	**VOC**	110.2	118,251	0.09%
	NO_x	141.1	212,477	0.07%
	PM	425.1	161,925	0.26%
Alternative 2 Modified	**VOC**	109.7	118,251	0.09%
	NO_x	83.7	212,477	0.04%
	PM	5.0	161,925	0.00%
Alternative 3	**VOC**	87.4	118,251	0.07%
	NO_x	72.2	212,477	0.03%
	PM	46.1	161,925	0.03%
Alternative 4	**VOC**	115.2	118,251	0.10%
	NO_x	229.8	212,477	0.11%
	PM	1,055.3	161,925	0.65%

The previous analyses show that estimated emissions from MNF management activities are expected to comprise only a small percentage of the total regional pollution load. While the MNF must be cognizant of air quality effects resulting from management activities, the Forest must also consider how air pollution from sources external to the MNF affect forest resources such as water quality and soil productivity, and in turn how this may guide management decisions. Air pollution disperses beyond political or jurisdictional boundaries, and regardless of the pollution source, air pollutants can have adverse effects on Forest resources and visitor experience. The Current Conditions section documents that some sensitive resources on the MNF are already adversely affected. A general misconception is that the MNF has no role to play in reducing, minimizing, or mitigating adverse air pollution impacts to the Forest from external sources, such as electric generating stations, industrial processes, and automobiles. Although it has been stated elsewhere in this document, there are ways in which the MNF can participate in the regulatory arena; these have been reiterated below.

First, federal land managers can, and in some cases are required by law, to participate in regulatory actions such as PSD permitting processes and Regional Planning Organizations aimed at reducing the impacts of regional haze and other pollution related impacts in Class I areas. Though these regulatory processes, federal land managers advise and provide consultation to state and federal air regulatory agencies on how new and existing sources of air pollution are affecting the resources and Class I areas on the MNF. This process of consultation has the potential to directly affect the outcome of regulatory decisions related to air quality. The revised MNF Forest Plan contains goals, objectives and standards aimed at continued involvement in these regulatory processes in effort to reduce, to the greatest extent possible, harmful levels of pollution inputs on the Forest.

Second, it is important not only to understand not only how much pollution is reaching the Forest, but how these current levels of pollution are affecting Forest resources. Long-term air quality monitoring on and near the MNF has helped establish air pollution trends, but determining what levels of pollution reductions are needed to restore areas already negatively affected and protect those that are at risk but not yet showing decline is not as well understood. For example, it is well known that many streams on the MNF have been adversely affected by acid deposition and have exhibited changes in stream chemistry, but changes in soil chemistry, and in turn, changes in vegetation are not as well documented or studied. Having a better understanding how sensitive soils are being affected would provide a more complete picture of the pollution problem and valuable information for resource management decisions. The MNF has begun to address this issue in this Forest Plan revision, and will continue to initiate and support monitoring and information-gathering efforts on the Forest. Additionally, determining terrestrial and aquatic critical loads (and setting target loads) for the MNF would assist resource manager in understanding the impacts of current levels of acidic deposition as well as effectively communicating these impacts to state air regulators and members of the public.

Soil Resource

INTRODUCTION

"The soil is a natural body, differentiated into horizons of mineral and organic constituents, usually unconsolidated, of variable depth, which differs from the parent material below in morphology, physical properties and constitution, chemical properties and composition, and biological characteristics," (J.S. Joffe 1936). This is just one of many scientific definitions of soil, and to date there is no known universal agreement on the actual definition of soil, and there seems to be no need for one. Farmers, scientists, engineers, theologians, and presidents of nations have long contemplated soil. Thomas Jefferson is known as the first soil surveyor in the United States, taking great care to inventory the soil on his farm. Franklin Delano Roosevelt once noted, "The nation that destroys its soil destroys itself." Soils are typically formed through a combination of five factors: climate, landscape, biological influence, parent material, and time. A sixth influential factor is human activity, and this factor can often play the greatest role in soil development and productivity.

The desired condition for the soil resource on the Monongahela National Forest (MNF) is to maintain or improve soil quality and soil productivity. Soil protective cover, soil organic matter, and coarse woody material are at levels that maintain the natural infiltration capacity, moisture regime, and productivity of the soil. Soils also have adequate physical, biological, and chemical properties to support desired vegetation growth. Exposed mineral soil and soil compaction from human activity may be present but are dispersed and do not impair the productivity and fertility of the soil.

Need for Change

Two Need for Change topics that helped generate Forest Plan revision for the Monongahela were the ongoing subject of sedimentation and the new topic of acid deposition related to air quality and soil productivity. When asked to identify issues or concerns for revision during the scoping process, many people focused on water quality and soil productivity. Citizens wanted to see a continued emphasis on improving water quality and addressing erosion and sediment on the Forest so as to promote healthy aquatic habitats. Some individuals, organizations and agencies also wanted to see the Forest address acid deposition, and the effect it may be having on Forest resources. In the 1986 Forest Plan, acid deposition was an issue considered but not brought forward due to the general feeling that the Forest could not do anything about the potential effects from acid deposition. This position has changed and will be discussed in greater detail later in this analysis.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect the soil resource.

Background

Erosion and acid deposition occur to varying degrees across the entire Forest, and their effects to soil can be exacerbated by soil disturbance. The Management Prescriptions (MPs) in the Forest Plan provide for a variety of activities to occur on varying soil types, ranging from little or no management (i.e., soil disturbance) in Wilderness areas to activities that call for a total commitment of the soil resource where soil is removed and replaced with a permanent facility. Although certain soil-disturbing activities, like mineral development or livestock grazing, can occur in localized areas throughout the Forest, large-scale soil disturbance associated with timber harvest and road construction most often occur in MPs with suitable timberland. Because the amount and distribution of these MPs and their predicted activities vary by alternative, the alternatives can be used to show relative differences in the potential that timber harvest and road construction may have for impacts on soil quality and productivity related to:

1) Soil erosion and sedimentation, and
2) Soil nutrient depletion and soil acidification related to acid deposition

Indicators

The following indicators will be used to reflect the potential relative change under each alternative based on anticipated levels of management activities that could have substantial effects on the soil resource.

- Acres of Potential Timber Harvest in Suited MPs by Alternative

The Soil Erosion Hazard Rating layer was overlaid with MPs that have land considered suitable for timber production, and it was determined that all alternatives have a consistently high percentage of their suitable land in areas that have a "severe" rating for soil erosion potential. However, each alternative would have a different amount of potential timber harvest activities that could occur on those soils that are more susceptible to erosion from harvest and road-related soil disturbance.

- Acres and Percent Of High-Risk Acid-Sensitive Soils By MP by Alternative

The Soil Nutrient Sensitivity and MP layers were overlaid to show where the Forest potentially has soils that are more susceptible to further soil acidification from harvest and road-related soil disturbance.

These indicators where chosen in part due to scale. At a Forest-wide analysis level, soil disturbances associated with timber harvesting and road building account for by far the largest percentage or acreage of soil disturbance. Minor disturbances related to recreation improvements, grazing, mineral development, and watershed restoration occur but are typically negligible when compared to timber harvesting and road building.

Scope of the Analysis

For sedimentation and erosion, the affected area for direct and indirect effects to the soil resource is the lands administered by the Monongahela National Forest (MNF). Further focus will be placed on MPs with suitable timberlands that are most likely to have activities that produce soil disturbance. The affected area for cumulative effects will include private land within the Forest proclamation boundary. This expanded area will facilitate a discussion of how other activities on Forest land may affect soil erosion and sedimentation both on and off the Forest, and how activities off the Forest may have a cumulative influence on forest soils.

For soil nutrient loss related to acid deposition effects, the affected area for direct and indirect effects to the soil resource is the land administered by the Forest. Further focus will be placed on the MPs with suitable timberland that are most likely to have activities that produce soil disturbance. The affected area for cumulative effects will extend beyond land administered by the Forest to include entire watersheds because of the links between air quality, soil quality, water quality and aquatic habitat. Pollution source areas well beyond the Forest boundaries will also be discussed in order to show the far-reaching nature of this issue.

This analysis will identify potential temporary, short-term and long-term effects. Temporary effects are assumed to last weeks or months, short-term effects 1-15 years, and long-term effects last greater than 15 years.

CURRENT CONDITIONS

Soil Erosion and Sediment

The soils of the MNF are developed under a mesic climatic temperature regime (mean annual air temperature is 48 degrees Fahrenheit) and an udic soil moisture regime (mean annual precipitation is 58 inches). The parent material that underlies the soils is comprised of sedimentary geology that makes up the Appalachia Ridge and Valley and the Allegheny Plateau Provinces. The soils on the Forest have been subject to the effects of extensive tree cutting and slash burning, most of which occurred between 1890 and 1935. These human-induced activities resulted in damaging floods, severe erosion, topsoil loss, and pollution of streams used for water supply. Subsequent fires further increased erosion. The fires at the turn of the century burned so hot that soil carbon was lost to the atmosphere, and lost soil productivity in some areas on the Forest was irreversible. Although there has been recovery over the past century, soils on many forested landscapes on the Forest still have thin surface horizons, and in some areas soil is essentially non-existent.

The soils of the Forest have developed from sedimentary rocks, and are divided into two zones, which differ in soil patterns. The Allegheny Plateau Province has relatively flat-lying bedrock. Soils on the plateau are characterized by high moisture content, thick humus, acidic conditions, and low nutrient levels. High timber productivity in the province is more a function of soil moisture than fertility. Limestone areas are more fertile and have often been cleared for pasture. In the Ridge and Valley Province, bedrock is folded, faulted, and fractured. Rock outcrops and escarpments are common. Soils are often shallow, shaley, draughty, and not highly productive. Most of the forest soils exhibit moderate to severe erosion potential, and high hazard areas exist in areas of shale and limestone. High hazard with regard to limestone refers to karst formations and caves. Sinks and land subsidence can occur and pose a risk, and ground disturbance within these areas can introduce sediment into the under workings of the karst formations. High hazard areas with regard to shale refer to shale formations that have exposed dips and sometimes result in large mass wasting events. Also, often soil types forming from these shales are shallow, droughty, and difficult to keep vegetated. Therefore, operating in these areas could result in substantial loss of sensitive habitat (i.e., shale barrens) or result in a loss of soil productivity that could prevent the return of vegetation.

Soil inventory was a major emphasis in the 1986 Forest Plan. Soil inventories were completed on 85 percent of the Forest during the past 18 years. The Natural Resource Conservation Service is currently updating an existing but outdated soil inventory in Tucker, Barbour, Preston, and northern Randolph Counties. The anticipated date of completion for these soil surveys is 2010. The Forest will then have a complete updated soil inventory layer that can be utilized in an integrated manner to assess effects from management activities. Existing information can now be accessed through the Internet and NRCS databases.

This analysis focuses on harvest and road-related management activities and their specific relationship with erosion/sedimentation potential. The reason for this is the intensity and magnitude that the effects from these activities have on the soil resource. Road construction/ reconstruction has perhaps the most dramatic and long-lasting effect of Forest Service land management activities and timber harvest is probably the most widespread of our activities.

Erosion is considered in this document as soil movement and not soil loss. Soil material may or may not move from a site or to a stream channel. Many factors influence soil movement, and when soil moves, it is deposited somewhere. Depositional areas may benefit from the addition of this eroded soil. Gully erosion is an extreme case of soil movement and would be considered a long-term negative effect to soil productivity. Gully erosion is evidence that large amounts of soil have moved away and will only be replaced over the long term (over 100 years). Other forms of erosion are not as detrimental and would only continue until vegetative cover is established.

Gully erosion is difficult to predict and depends on several factors. There is evidence on this Forest that some soil types are more susceptible to gully erosion and mass movement than other soil types. Soils that form from the geologic parent material of the Mauch Chunk formation have exhibited this behavior both naturally and with human-caused soil disturbance. An excellent example of the induced erosion and mass movement of these soils occurs along the Highland Scenic Highway. Other soil types over geologies such as the Chemung and Hampshire formations are also susceptible to mass movement. Areas in the northern portion of the Forest have large portions of the landscape that are overlain with colluvial soils. In some areas, hidden ancient landslides dot the landscape, posing potential risk for mass movement when disturbed. Steep slopes and the dip of the geologic formation also increase the risk of mass movement. These areas are typically identified in watershed assessments and are further scrutinized when planning for a project. Most often avoidance is the best mitigation.

Recent work with NASIS (Natural Resource Conservation Service, National Soil Information System database) shows that the majority of the Forest soils have a moderate to severe erosion potential when disturbed. A soil erosion susceptibility layer was created for the Analysis of the Management Situation for Forest Plan revision (Soil AMS, Appendix A, Map 1, Forest Plan project record).

Historically, soil erosion was the principal concern affecting forest soil productivity. The issue was loss of organic matter that harbors nutrients and helps maintain soil aeration. However, it has been since found that soil organic matter is not lost from harvest sites, even those clearcut or where all the tree boles, tops, and limbs are removed (Johnson et al. 1991). Instead, it is redistributed in the upper mineral soil layers during harvesting. In addition, it is now known that root decay re-supplies the organic matter more quickly than erosion or respiration depletes it. Soil erosion continues to be a concern for potential sediment production and effects on aquatics. More information can be found in the *Watershed, Riparian and Aquatic Resources* section.

Today, there is a more general concern about soil nutrients, especially the loss of calcium due to a combination of impacts from atmospheric deposition and timber harvest (Federer et al., 1989). Calcium is important for such plant functions as growth regulation and disease resistance. The concerns here include possible changes in forest health, forest productivity, and forest species composition.

Because forest health issues differ by temporal and spatial scales, any definition of forest health is likely to be conceptual in nature. The use of the term "health" is controversial since health is easy to comprehend in terms of the human body, however it may not be appropriate for ecosystems such as a forest. However, some researchers and managers have determined characteristics of what are considered healthy forests. Kolb et al. (1994) propose the following characteristics as a definition of forest health: 1) physical and biotic resources to support forest cover; 2) resistance to dramatic change; 3) functional equilibrium between supply and demand of essential resources; and 4) diversity of seral stages and stand structures. Forest productivity in a broad sense can be defined as the goods and services provided by the land base. Forest species composition is associated with the number of different species present and includes the range of habitat characteristics that each species needs to survive. The loss of calcium in the ecosystem could potentially lead to a decline in these forest factors, but this is very difficult to assess given the variability of external and internal influences that affect forest health, forest productivity and forest species composition.

Soils at higher elevations on the Forest tend to be hydrologically shallow and on steep terrain. With few exceptions, these lands have severe soil erosion hazard ratings related to road construction and lower forest productivity relative to lower elevation sites. Also higher elevations, especially above 3,000 feet, receive greater amounts of atmospheric pollutants (MNF Wet Sulfate Deposition Map), especially sulfate (SO_4^{-2}) and nitrate (NO_3^{-}). These pollutants affect the chemistry of the soil in a way that may lead to loss of important nutrients, such as calcium, and mobilization of others, such as aluminum, that may affect forest productivity. Accelerated human-induced soil erosion is associated with certain management activities, and it can indirectly affect water quality and aquatic habitats when the sediment reaches a stream channel. However, this issue now shares the spotlight with soil productivity concerns related to acid deposition. This newly addressed issue is described below.

Acid Deposition

Soil acidification can be seen as a balance between acid inputs and mineral weathering (Binkley et al. 1989). Therefore, when soil-acidifying processes (such as acid deposition and forest growth) exceed mineral weathering inputs of base cations, acidification occurs. Base cations are nonacid positively charged ions of calcium, magnesium, potassium, and sodium.

Changes in soil chemistry are difficult to quantify due to the long periods of time over which they occur, the complexity of the factors controlling them, and the inherent spatial heterogeneity of soils. A study of soil acidification in the Calhoun Experimental Forest in South Carolina using soil data from 1962 to 1990 showed that the upper 60 centimeters of soil acidified at an accelerated rate due to acidic deposition while the naturally acidifying processes of biomass accumulation, root and microbial respiration, and organic matter incorporation also occurred (Markewitz et al. 1998).

Soil acidification increases cation leaching, decreases soil pH and base saturation, increases the nitrogen content of trees, and negatively affects many biological processes (Adams and Kochenderfer 1999). Adams (1999) found that calcium losses were particularly large when a forest soil becomes acidified. A nine-year acidification study at Bear Brook watershed in Maine showed accelerated loss of base cations from the soil, which subsequently leached into the streams (Fernandez et al. 2003). Base cations also are removed from the soil by plant uptake, leaching, and harvesting (Gbondo-Tugbawa and Driscoll 2002).

The major base cations in atmospheric deposition, soils, and geologic materials are calcium, magnesium, potassium, and sodium. Of these, calcium and magnesium typically provide the greatest contribution to buffering because they usually are more abundant than potassium and sodium, and they possess a greater positive charge. Mineral weathering of soil and geologic materials controls base cation availability over the long term, but the major short-term sources of base cations to soil are litter fall and atmospheric deposition (Johnson and Todd 1990; Jenkins 2002). Slope position affects base cation supplies because litter accumulates more on lower slope positions than on higher ones (Johnson and Todd 1990; Jenkins 2002; and Schnably 2003).

The National Acid Precipitation Assessment Program (NAPAP) indicated that base cation depletion may affect the health of forest ecosystems, though forests have not yet shown adverse effects from acid deposition (NAPAP 1998). However, mortality and decline of red spruce *(Picea rubens)* at high elevations in the Northeast have been significant and provide recent evidence of forest damage by acidic deposition (NAPAP 1998). Sugar maple *(Acer saccharum)* also is a species of concern (Horsely et al. 2000; Likens et al. 1996; Bailey et al. 2004), because it is particularly sensitive to decreases in calcium and magnesium soil pools.

Water Quality and Aquatic Resources on the MNF

The MNF is the fourth largest national forest in the Eastern Region and contains the headwaters of five major rivers: the Monongahela, Potomac, Greenbrier, Elk, and Gauley. Portions of twelve rivers on the MNF are considered eligible for potential inclusion in the National Wild and Scenic Rivers System. Rivers and streams across the Forest provide more than 900 kilometers of coldwater trout streams and an additional 200 kilometers of warm water fishing. Although the State of West Virginia manages many stream segments as put-and-take trout fisheries with seasonal trout stocking, some estimates indicate that 90 percent of West Virginia's native brook trout streams occur on the MNF.

Water chemistry of streams and rivers is the by-product of dynamic nutrient pathways and chemical processes occurring within the contributing watershed environment – atmospheric, terrestrial, and biological. The significance of water chemistry is perhaps no more apparent than in aquatic ecosystems composed of diverse geology, particularly when these systems are exposed to acid deposition. Watersheds across the MNF are composed of a wide range of surficial geologies that have variable capacities for neutralizing acid inputs.

Healthy, reproducing trout populations and their associated communities have various habitat requirements. Water quality in rivers and streams is an important consideration when establishing management priorities on the Forest to provide for the maintenance of healthy aquatic ecosystems. Water chemistry is one component of water quality and represents a fundamental building block for aquatic communities. For example, harmful effects to certain aquatic organisms begin to occur as pH values in streams fall below 6.0; detrimental effects occur to most aquatic organisms as pH falls below 5.0. Also, values less than 50 for acid neutralizing capacity (ANC) indicate a stream system is acid sensitive, values less than 25 suggest a system likely experiences episodic acidification during storms, and negative ANC values indicate a system is already acidic (http://www.dep.state.wv.us).

In 2001, the MNF initiated an effort to establish Forest-wide monitoring of water chemistry properties in streams across the Forest. Sample sites were strategically located to increase the level of understanding of the relationships between water chemistry and various local environmental factors including the geologic composition of contributing watershed areas, rates of acid deposition, and supported aquatic communities. Results of water chemistry monitoring from fall low flow and spring high flow sampling across the Forest demonstrated a high degree of variability between sample locations and sample periods, as expected. For example, measures of pH ranged from 3.88 to 8.2 (mean = 6.8) during fall 2001 samples (low flow conditions) and from 3.73 to 8.55 (mean = 6.4) during spring 2002 samples (high flow conditions). Measures of ANC ranged from -166 to 2868 (mean = 407) during fall 2001 samples, and from -195 to 1599 (mean = 135) during spring 2002 samples.

Variation in measures of pH and ANC between sample locations was largely explained by the variable capacity of a watershed's geology to neutralize acid inputs. Variation in measures of pH and ANC between sample periods at a given site was largely explained by the different stream discharge conditions. Except where acid mine drainage is an issue, water samples collected at low flow conditions during the late summer to early fall period are typically expected to exhibit higher pH and ANC values due to the greater influence of groundwater on stream flows as compared to spring high flow conditions when direct inputs from melting snow and precipitation (i.e., acid rain) have greater influence.

State water quality monitoring programs are also documenting cases of stream acidification in West Virginia. In an attempt to mitigate impacts of stream acidification on native trout streams and the recreational fishing opportunities they provide, the State has developed and refined a program to treat acid impaired streams with limestone sand. Limestone sand is currently being applied to acid-impaired streams on the Forest and across the State to help neutralize acidity. Forest monitoring results show water chemistry downstream from treatment areas exhibit notable increases in ANC, pH, and Ca when compared to untreated water upstream. Although this action helps to mitigate against many symptoms of stream acidification within the effective stream treatment zone, it does not affect the underlying cause of the condition to address risks to aquatic and terrestrial ecological processes and functions that extend beyond the treatment zones (McClurg 2004).

The Occurrence of Acid Conditions and Acid Sensitivity on the MNF

Soil, water, and stream acidification are real phenomena that have been shown to occur in West Virginia. Evidence of nutrient depletion in certain soils on the MNF has been found (Jenkins 2002; Schnably 2003; unpublished soil chemistry data for 2004 Soil Resource Monitoring Report). Long-term, increasing losses of base cations to stream water due to ambient acid deposition have been documented in stream water on a control watershed in the Fernow Experimental Forest, which is located in the MNF (Edwards and Helvey 1991). Other watersheds on and near the Fernow Experimental Forest that have been artificially acidified with sulfur and nitrogen to determine effects on soils and stream water have shown mobilization of base cations in soil and consequent leaching to stream water and substantial reductions in the acid-neutralizing capacity of soil water (Edwards et al. 2002a, 2002b).

Otter Creek Wilderness is a popular recreation area on the MNF, and because it also is designated a Class I air quality area it has been intensively monitored to characterize the extent of acidic water, soils, and geology (Webb et al. 1997; personal communications with Jenkins 2004; Adams et al. 1991.) An estimated 71 percent of the Otter Creek Wilderness is underlain by geologic material of the Pennsylvanian age. The dominant geology is the Pottsville Group, which generally has very acidic strata. Many of the sandstones associated with Pottsville geology are resistant to weathering, and weathered materials produce very acidic soils, with pH values ranging from 3.5 to 4.6. Only small base cation reserves exist to be weathered to the soil, so there is little to no acid-neutralizing capacity available (Jenkins 2002).

Some of the soil types found in the Otter Creek watershed also have elevated aluminum, which poses a threat to forest productivity and exacerbates soil nutrient deficiencies (Jenkins 2002). Jenkins (2002) found that some of the soils studied from Otter Creek have such a low buffering capacity for acid deposition that these forests are at nearly a 100 percent risk for decline in productivity. High aluminum concentrations are present in soils supporting declining spruce stands in northeastern United States and are commonly thought to inhibit calcium uptake and transport (Shortle and Smith 1988). Red spruce *(Picea rubens)* is a dominant tree species growing in the high elevation soils of Otter Creek Wilderness, and it is an important ecosystem component for several rare or listed species on the MNF.

While Otter Creek has been intensively monitored, more widespread continuous monitoring of soils around the MNF has taken place since before the 1970s through cooperative efforts between the USDA - Natural Resource Conservation Service (formally the USDA Soil Conservation Service) and the MNF to develop and publish county soil survey reports. While the data are not complete and the soil pits from which the data were obtained were not always located in areas of interest to the MNF, the soil data were collected across multiple geologies over time and are very useful in helping to assess soil productivity.

Since 1995, additional intensive soil data collection continues to be done to develop baseline soil chemistry data across the MNF, especially in areas assessed by the Soil Nutrient Sensitivity Map (described below) to be highly sensitive to acidification. More than 500 soil samples have been collected across varying soil types, landscape positions, and varying aspects and analyzed for physical and chemical characteristics. Preliminary results show that soils in highly sensitive areas are affected adversely by acid deposition. Base saturation values often are below 15 percent, and calcium to aluminum ratios are often less than 1.0 for soils found on ridgetops and benches in the surface horizons. Some south-facing cove soils have soil aluminum levels in the surface horizon and subsurface horizons that might indicate possible toxicity for vegetation.

Soil Nutrient Sensitivity on the MNF

Acid deposition and its effects on soil productivity arose as an emerging issue during the scoping phase of Forest Plan revision in 2003. After a review of the literature, discussions with research scientists, and discussions with internal interdisciplinary team members, the issue was brought forward as a primary Need for Change topic during Forest Plan revision. Soil productivity issues and mitigations on disturbed land were addressed in the 1986 Forest Plan (USDA-Forest Service, p. 79 and Appendix S), but there was no consideration of soil productivity losses caused by base cation depletion on undisturbed soils.

To address this issue in Forest Plan revision, areas on the MNF susceptible to potential effects of acid deposition first were identified and mapped using a multi-step process. The initial map data layer in the analysis was the geology layer; geology was ranked as high, medium, or low for sensitivity based on the geochemistry from county geology documents and personal knowledge of MNF geologists. Geology known to have substantial sources of alkalinity was assigned low sensitivity because it could provide a reasonable level of buffering capacity to soil. Geology known to have only trace amounts of alkaline-producing minerals was rated as high sensitivity. All other geologic formations were rated as moderate based on general knowledge about the availability of moderate amounts of alkalinity in the strata (Edwards et al. 2004).

The second map data layer included in the analysis was the stream layer of the MNF. Streams were analyzed for water quality impacts from acid rain and mine drainage using the current 303d listing from the state (http://www.dep.state.wv.us). Sources of acidity were identified in the stream layer. The correlation between geology and stream water quality is strong. Where high geologic sensitivity exists on the MNF, acid rain impaired streams are typically present. Some streams flow through areas of low sensitivity but remain impaired due to the large effect from upstream geochemistry, soil chemistry, and precipitation chemistry.

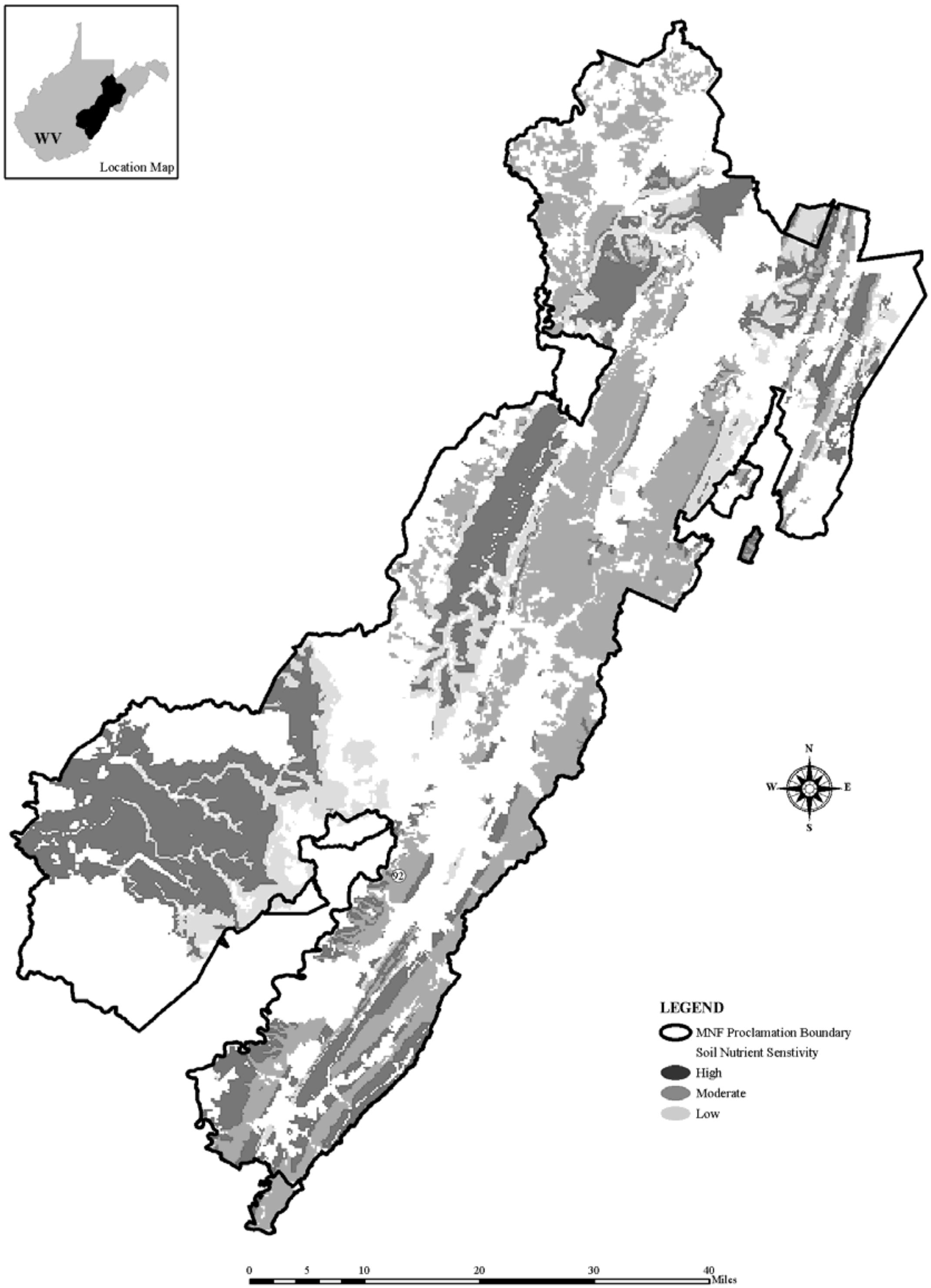
The third map data layer was SO_4^{-2} deposition across the MNF. Deposition data were generated by Dr. James Lynch at Pennsylvania State University. Areas of the MNF that received high amounts of wet SO_4^{-2} deposition rates were identified with this map layer (see Sulfate Deposition Map in the Map Packet). The combination of these three analysis layers provides an overall picture of acid deposition sensitivity across the MNF (see Figure SL-1).

In general, an area with highly sensitive geology, high rates of sulfate deposition, and acid rain impaired streams would indicate potential soil productivity concerns in the surrounding watershed. An area with moderate sensitivity, high rate of sulfate deposition, and a non-acid impaired stream may indicate an area that may not be susceptible. However this area would require an assessment of any monitoring data and a site visit by a specialist. The acid deposition sensitivity layer (Soil Nutrient Sensitivity Map) is being used at the Forest Plan revision level, the Forest-wide level for analysis, and the watershed assessment level.

Critical Loads

Ultimately, the ability to calculate an array of target sulfur and nitrogen deposition loads based on specific forest management alternatives is a goal that the Forest would like to achieve. While critical load is the amount of pollution that results in a specific harmful level of effect to the environment, a target load is chosen to reflect policy or management decisions for resource protection. In areas where critical loads have been exceeded such as acidified streams, a target load would be set as a milestone toward recovery. Currently, the Forest does not have all the necessary data to determine critical target loads for the many combinations of deposition, geology, soil, and water chemical characteristics present on Forest. Data collected within the Forest's various resource staff areas, routine monitoring programs, and data that will be collected as a result of the monitoring program set forth in Forest Plan revision will be used to evaluate and refine current conditions using the Soil Nutrient Sensitivity Map and eventually to develop target loads. The necessary stream, soil, and soil water data have been collected from a few sites on the Forest to calibrate the MAGIC (Model of Acidification of Groundwater in Catchments) model, which will be used to calculate an array of loads. Selection of critical or target loads for the many types of sites on Forest will provide a tool that land managers can use to better protect resources. Land managers can then assess how various land management alternatives might affect desired future conditions based on an array of critical loads. At the regional or national scale, policy makers can use critical loads to help determine what levels of pollutant reductions would be needed to achieve desired future conditions on larger landscape or regional scales.

Figure SL-1. Potential Soil Nutrient Sensitivity to the Effects of Acid Deposition on the Monongahela National Forest



ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Below are the mitigation or management requirements common to all alternatives that will be used to protect soil resources. Resource protection methods come in the form of laws, regulations, policies, Forest Service Manual and Handbook direction, Regional guidance, Forest Plan direction, and Forest Plan implementation procedures.

Laws, Regulations, and Policies

Numerous laws, regulations, and policies govern the management of soil resources on National Forest System (NFS) land. National laws and regulations have also been interpreted for implementation in Forest Service Manuals, Handbooks, and Regional Guides. All management activities and facilities must comply with these laws, regulations, and policies, which are not only intended to provide general guidance for implementation, but also protection of soil resources. Some of the more influential laws, regulations, and policies governing management on federal land are referenced below.

- Forest and Rangeland Renewable Resource Planning Act (RPA) of 1974, as amended by the National Forest Management Act (NFMA) of 1976) – The NFMA directs the Secretary of Agriculture to protect and, where appropriate, improve the quality of soil, water, and air resources. The RPA requires an assessment of the present and potential productivity of the land. Regulations specify guidelines for land management plans developed to achieve the goals of the program that "…insure that timber will be harvested from NFS land only where …soil, slope or other watershed conditions will not be irreversibly damaged." The NFMA amended RPA by adding sections that stressed the maintenance of productivity, the protection and improvement of soil and water resources, and avoidance of permanent impairment of the productive capability of the land.

- Water and soil resources are also protected in order to comply with State water quality management plans and applicable provisions of the Clean Water Act of 1977 (P.L. 95-217). The Act contains direction to minimize non-point source pollution to the maximum extent that is technically and economically feasible.

In addition to this guidance, there are other laws, policies, and direction that pertain to soils management on private land and direct the National Soil Survey Program administered by the USDA Natural Resource Conservation Service. Because the Forest Service partners with other agencies, we also utilize additional laws, policies, and direction to accomplish partnership goals and objectives.

Regional Guidance

The Region 9 Soil Management Handbook (FSH 2509.18) has a threshold of 15 percent reduction in "measurable or observable soil properties or conditions, or any measurable or observable reduction in soil wetland or hydrologic function", referred to here as soil productivity or soil quality. This measurement is applied to activity areas. System roads, trails, and administrative facilities such as campgrounds, are not included in measurements for loss of soil productivity.

Forest Plan Direction

In the 1986 Forest Plan, direction for the management and protection of soil resources occurs at three levels, Forest-wide, MP, and Appendix S. For Forest Plan revision, Forest-wide direction has been expanded to include additional goals, and a new description of desired conditions. Objectives, standards, and guidelines have also been rewritten in some instances to provide more concise and clearer direction, and better integration between soils and other resources. Some 1986 Forest Plan direction has been removed, including items that were process-oriented, or that repeated existing law or policy, or that conflicted with other resource management. Appendix S in the 1986 Forest Plan was reviewed in order to identify key management direction to carry forward into the 2006 Forest Plan. Once the direction was incorporated, there was no longer a need for Appendix S in the 2006 Forest Plan.

The principal task of the Forest Soils Program is to protect, maintain, and enhance the soil productivity of forests and rangelands. Activities in the soil program include updating inventories, assessing effects of management activities to the soil resource, planning proper mitigating measures, and monitoring the land's capability to produce goods and services sustainably.

In general, standards and guidelines are established to prevent erosion of the soil and overall loss of soil productivity from the Forest. Specifically, the standards and guidelines are designed to:
- Prevent or reduce erosion generated by management activities.
- Minimize the amount of time soils are exposed to potential weather events.
- Minimize loss of topsoil and overall management of topsoil.
- Minimize effects that land management activities have on the soil resource.
- Restore or rehabilitate disturbed soils to a level of stability and fertility so that vegetation can regrow.

Forest Plan Implementation

The 2006 Forest Plan's Forest-wide Management Direction (Chapter II) and Monitoring and Evaluation Plan (Chapter IV) will guide the protection, mitigation, and rehabilitation of the soil resource. This guidance will be used in project design to protect soils, while allowing an acceptable level of soil disturbance where appropriate. However, appropriate management of the soil resource also depends on current and site-specific information about existing physical conditions, desired conditions, and localized biophysical and socio-economic factors. These factors are not easily addressed at the programmatic level. Thus, management activities with the potential for disturbing or restoring the soil resource will also be addressed through a combination of watershed assessment, site-specific inventory, NEPA analysis, and monitoring.

Watershed Assessment – Assessments at the watershed scale can be used to identify past management history, geological considerations, soil-related concerns, general mitigation, and opportunities for resource restoration.

Inventory – Soil concerns related to erosion, sedimentation, or nutrient depletion can be identified at the watershed or project level through soil erosion sensitivity and soil nutrient sensitivity screening using Forest level mapping. Once concerns are identified, field visits are made for an Order 1 Soil Resource Inventory and/or soil and water chemical analyses.

NEPA Analysis – Proposed management activities and mitigation measures are analyzed for potential effects to the soil resource by alternative. Effects are disclosed to interested individuals, organizations, and agencies for review and comment. Site-specific design features and mitigation are carried forward into the decision document and applicable contract clauses, permits, or operating plans for the proposed project or activities. Based on field data collected, site-specific mitigation can be designed. This may include the simple application of Forest-wide direction, or it may include additional measures to protect or restore the soil resource such as siltation fences, sediment traps, alteration of proposed activities or methods, avoidance of high-risk areas, buffer extensions, leaving additional nutrient sources on site, liming, or fertilizing.

Monitoring and Evaluation – Monitoring can occur at the Forest-wide or project level to confirm that specific mitigation is occurring and that it has the desired effects. If evaluation of monitoring data shows that desired effects are not occurring, activities or mitigation can be adjusted to provide additional protection or restoration of the soil resource in the future. The Forest expects that research will advance in the area of monitoring acid deposition effects related to land management activities within the next decade. The Forest will need to be flexible in its implementation and monitoring methodologies in order to stay current with this evolving issue.

Effects Common to All Alternatives

Soil is an integral component of all national forest settings, and contributes to the quality of ecosystems. Soils have been altered in numerous locations across the Forest by both human and natural forces. Obvious and significant effects on the soil resource arise from a variety of resource management activities and public uses such as logging, mining, and utility corridors that alter the landscape. The relative amount of these activities and uses may, in some cases, vary by alternative. However, they are likely to be present to some extent in all alternatives.

General Effects - Soil Erosion and Sediment

An indirect effect of removing a soil's vegetative cover and its organic layer to create bare mineral soil is erosion, meaning soil movement. An undisturbed soil with soil layers intact and growing biomass is not highly susceptible to erosion. When the ground is disturbed in some way to expose bare mineral soil (A-horizon and lower), then soils on slopes become susceptible to raindrop impact, displacement, and overland flow with water. These forces can cause soil to move down slope, sometimes into stream channels, where it then becomes sediment and is incorporated into the bed load of the stream channel. Erosion will be considered a temporary or short-term effect and will be estimated mainly to consider the potential risk of sediment delivery to stream channels.

Forest management activities that may affect soils include timber harvest; road construction, reconstruction, and decommissioning; prescribed fire; facility relocation and modification; fish habitat improvement; stream bank stabilization; slope stabilization; and mining reclamation. Their effects are described in greater detail below.

Timber Harvest - Effects can vary depending upon the quantity and type of timber removed, logging methods, and the setting. Generally, timber removal—and any associated roads, skid trails and slash treatments—results in adverse effects to the soil resource arising from vegetation change or removal and ground disturbance. Thinnings and selection harvests usually have lower impacts and are also evident for a shorter duration than shelterwood harvests and clearcuts. Helicopter logging does not create skid trails or yarding corridors that contribute to the soil impacts of ground-based and cable logging systems. In helicopter logging or yarding, soil disturbance is much less. Field observations and ocular estimates of MNF timber sales in 2001 (North Gauley Mountain, Marlinton Ranger District), 2004 (Dry Run Timber Sale, Cheat Ranger District), and 2005 (unpublished soil monitoring data from the Smokecamp Timber Sale, Greenbrier Ranger District) show that very little ground disturbance occurs within an activity area during timber harvesting when using helicopters. A good estimate would be less than one percent of the activity area is disturbed. Therefore, effects from this harvest method are minimal.

The majority of soil disturbance in timber harvesting activities is associated with conventional operation methods (i.e., ground-based skidding.) In conventional harvesting methods using rubber tire skidders, skid trails and/or skid roads are created in order to extract the timber. Landings are also created in order to temporarily deck the timber until it can be loaded onto trucks and hauled off-site. The percent of land disturbed is often dependent on slope of the activity area. In general, the steeper the slope the higher the road density will be in order to safely operate on that slope. A 1977 study conducted near Parsons, WV showed that the lowest measured road density of 5.6 percent occurred in a selectively cut harvest area with slopes less than 30 percent (Kochenderfer 1977). A study on the nearby Fernow Experimental Forest indicated that roads on slopes greater than 30 percent in the Haddix watershed occupied 10.6 percent of the logged area (Kochenderfer et al. 1997).

Kochenderfer et al. (1997) reported that the amount of exposed soil because of skid trails and trucking roads decreases rapidly after logging. This is because grasses and shrubs become re-established in the disturbed areas. The study measured skid and truck roads in 1987 and again five years later in 1992. The percent of disturbed area in the skid roads decreased from 6.2 percent of the logged area in 1987 to 5.1 percent in 1992. The percent of disturbed area in truck roads decreased from 4.5 percent to 3.1 percent. It is thought that practically all of the skid roads, especially in heavily cut areas, would eventually convert back to forest. However, Kochenderfer et al. (1997) recommended that water-control structures (broad-based dips, waterbars, and other mitigations in the Hydrology Report) are necessary on closed-out roads whether they are skid roads, skid trails, or abandoned system roads, because bare soil can remain on these roads even after six growing seasons.

Landings are used in both conventional and helicopter harvest systems. Helicopter landings are generally around two and a half acres in size using conventional harvest systems. It is estimated that 100 percent of landing sites have reduced soil productivity because most of the topsoil and some of the mineral soil is cleared away to create a relative flat area for stock piling logs. This loss of soil is referred to as soil displacement. Revegetation can occur on these sites very quickly if treated by seeding, mulching and fertilizing. However, soil compaction can be a problem with lasting long-term effects. Landings are often revegetated and used as wildlife openings.

Roads and Trails - Construction, reconstruction, and decommissioning can all affect the soil resource. Road construction and reconstruction are usually associated with timber harvest, facility development, utility corridors, telecommunications sites, mineral and energy development, and recreation activities. The extent of effects depends on topography, service type (will the road receive aggregate?), soils, geology, hydrology and the nature of surrounding vegetation. The effects from trails is usually somewhat less due to their smaller width, which reduces the level of soil disturbance and makes effects easier to mitigate in most cases. Road and trail decommissioning includes a variety of management actions ranging from simple closures to complete obliteration. Obliteration can often ameliorate the soil quality effects of a road or trail over the long term as the soil stabilizes, hydrologic function returns, compaction decreases and vegetation matures in former road or trail locations; however, temporary or short-term effects of soil disturbance are often greater than if the road is simply closed with properly applied mitigation measures (i.e., waterbars, dips, out-sloping).

Mineral and Energy Exploration, Development, and Reclamation – Exploration and development activities can result in both short-term and long-term effects from associated structures, vegetation clearing, soil-disturbing activities, release of pond effluent, and rehabilitation work. The effects on the soil resource vary depending largely on the scale and location of development and mineral ownership. Underground mining would have limited effects to the soil resource, while small-scale and large-scale surface mining operations typically have major effects on the soil quality of the surrounding area. As noted in the *Mineral Resources* section of this chapter, soil disturbance associated with the most common mineral activity, natural gas development is estimated at no more than 15 to 16 acres per square mile. Mining reclamation activities can also result in temporary or short-term effects to the resource, but these effects are generally no worse than the conditions being reclaimed, and reclamation results in long-term improvement to the overall site productivity, including soil productivity. In that the level of mineral exploration and development is largely driven by market forces and regulated by existing mining law, there would be little difference between the alternatives in effects on the soil resource. The inherent uncertainty also does not allow for a meaningful predictive analysis between alternatives.

Facilities and Structures – These include a broad array of physical developments and structures, such as administrative facilities, utility developments, communications sites, dams and diversions authorized under special use authorizations, and mining facilities. Usually, there are both short-term and long-term effects from structures, site clearing, and soil disturbance. These effects vary depending on the scale and nature of the development, as well as the setting. Road construction for installation and/or maintenance purposes can contribute to the impacts from the facility. In general, once an area is committed to a facility or structure, the soil disturbed and soil productivity lost is viewed as a permanent commitment of the soil resource. The Region 9 Soil Management Handbook (FSH 2509.18) provides direction in how to account for soil disturbance of these areas.

Recreation - Activities can result in effects to the soil resource depending on recreation activity levels and soil types. Off-road and off-trail travel and dispersed camping can cause erosion, compaction, and/or ground disturbance resulting in bare mineral soil exposure, or loss of vegetation. Although all forms of travel have the potential to cause these types of impacts, effects associated with most forms of motorized travel are usually the most pronounced due to the combination of vehicle weights, widths, and their creation of continuous track lines. Off-road and off-trail vehicular traffic is currently prohibited on the Forest. Horse travel, which is not prohibited, is the second-most impactive activity on trails. Mountain biking also has the ability to cause soil disturbance that may lead to erosion and sedimentation. Volume of use also contributes to the effects. Some trails are more popular for horse use, while others are more appealing for mountain bike use. Trail access and uses are not expected to vary significantly by alternative. There are no foreseeable future plans to develop any large-scale recreation facilities or make any changes in the types of recreation allowed on the Forest. Therefore, there are no measurable differences in soil-disturbing recreation-related activities that can be analyzed by alternative.

Range Management - Livestock grazing and range improvements may result in extensive soil effects, especially on sensitive soil types and in areas where grazing is concentrated. Effects to the soil resource from grazing depend largely on the intensity and timing of forage utilization. Normally, allotment management plans require permitees to move their livestock so that they do not concentrate in sensitive areas, like meadows and riparian areas. Although there could be effects from seasonal trampling and heavy utilization of the soil, the potential for change to the soil resource is relatively slight, especially as livestock grazing only occurs on less than one percent of the entire Forest and the animal units per acre are strictly regulated. Mitigation may include developing feeding pads, water cisterns for drinking with an associated hardened pad, and fencing of riparian areas and sensitive wet soils with associated meadow habitat. All of these mitigations act to lessen soil compaction, soil disturbance, erosion and sediment production, and changes in the soil hydrology. Fertilization and liming of pastures by permitees can also help replenish nutrients lost by grazing. There is currently no expectation to change the size or amounts of the range allotments under the 1986 or 2006 Forest Plan direction under any alternative. Therefore, there are no measurable differences in soil disturbance activities that can be compared by alternative.

Watershed Improvements - A broad array of physical alterations to the riparian habitat may include stream bank and channel stabilization structures (rock gabions, rock riprap, etc.), road reconstruction (culvert replacements, road re-alignment, etc.), slope stabilization structures, and revegetation. Virtually all of the alterations require soil disturbance in order to conduct these improvements. The duration of effects from these types of structures ranges from short term to long term and also depends on the scale of the structures themselves. Generally, most improvements are relatively small and localized, and have a minor effect on the loss of soil and short-term pulses of sediment added to the riparian corridor. These structures have the beneficial effect of reducing erosion and sedimentation over the long term. Additional mitigation such as seeding and mulching can ameliorate the short-term effects from sediment until soils are stabilized.

There will likely be opportunities to reduce soil productivity losses and soil erosion on the landscape through activities that decrease the effects of existing development and historic activities. One such activity that has that potential is road decommissioning. Although decommissioning can range from road closures to complete road obliteration and restoration, all activities would generally allow for some revegetation to occur along road prisms and cut and fill slopes. This revegetation and re-contouring would reduce the potential for soil erosion, increase hydraulic conductivity, and decrease soil compaction of existing road openings. Usually road decommissioning is a long-term benefit to soils that increases in effectiveness over time as vegetation is re-established and soil forming processes take hold. However, these opportunities will not be compared across alternative because of the uncertainty of where and when these opportunities may occur at the Forest-wide scale. They are typically and appropriately identified at the watershed or project levels.

Fish and Wildlife Habitat Improvements - A broad array of physical alterations may include vegetation manipulations (maintained wildlife openings, browse species plantings, etc.), prescribed burning, and habitat improvement structures. Structural improvements do not adversely affect the soil resource. Soil disturbance is minimal. Wildlife openings are often associated with areas previously used as log landings for timber harvest. Converting these landing areas into a wildlife opening acts to stabilize the soil and encourage vegetative growth on site. The A and O horizons of the soil are scraped off in some places and some compaction remains in the area, but overall the site is generally mitigated with minor losses of soil productivity. Waterholes result in a permanent loss of soil productivity. These areas are less than a half acre in size and add up to less than .01 percent total acreage of the entire Forest. Savannahs result in the greatest negative effect to the soil resource. The soil is greatly disturbed in the creation of a savannah. Short-term effects are the loss of the A and O horizon being incorporated into the soil profile. The site is converted into grassland. These areas can be up to 10 acres in size or more. Negative impacts may be mitigated through design and location considerations and vegetative cover plantings where possible. Other than savannahs, improvements are small and localized, and have a minor effect on the soil quality of the surrounding area. However, improvements will not be compared across alternatives because of the uncertainty of where and when these opportunities may occur at the Forest-wide scale.

Wildfire Suppression – Fire suppression activities produce effects to the soil resource both directly and indirectly. Some firefighting activities, such as mechanical fire line and safety zone construction, can result in direct, long-term effects from vegetation clearing and soil disturbance. In the case of fire line construction, these effects are usually magnified by the linear nature of the pattern of disturbance and the crossing of stream channels. This linear nature of the soil disturbance can result in routing sediment directly into a stream. This effect can be mitigated by hand constructing waterbars and small dips to disperse flow onto sideslopes. These areas can also be rehabilitated after suppression with mulching and seeding to stabilize disturbed soils. Although the risk of wildfire associated with aging timber stands could vary somewhat by alternative, the timing, location, and intensity of actual wildfires and suppression activities are unpredictable and will therefore not be included in this analysis.

Prescribed Fire –Prescribed fire is generally used in areas characterized by non-lethal or mixed fire regimes to reduce ladder fuels and restore or maintain desired vegetative conditions. In these circumstances, fire intensity, severity, and scale are generally lower and smaller, and result in less impacts of shorter duration than wildland fire events. Studies in the Southern Appalachians show that, in general, even high-intensity prescribed fire on steep slopes did not significantly increase soil movement or nutrient losses (Van Lear and Danielovich 1988.) This activity may vary by alternative; but due to the nature of prescribed fire on this Forest (see *Vegetation Management* section), it does not produce large-scale soil disturbance. If prescribed burn plans are followed and low-intensity burns typically occur as planned, then the effects would be minimal and temporary to the soil resource.

Special Uses – Special use authorizations vary greatly, from operating concessions to erecting and maintaining large facilities like transmission lines. Some of these activities have the potential for soil disturbance, others do not. The general activities associated with special uses that would affect soils—such as facility and road construction, timber removal, or recreation events—are addressed above. Individual authorizations are for localized areas, and the number, type, and location are unpredictable. Proposals would be analyzed on a case-by-case basis at the project level and would not likely vary by alternative for this analysis.

General Effects - Acid Deposition

Current investigations about long-term soil productivity are focusing on soil calcium and forest health. This is because some site-specific evidence, based on small watershed studies, indicates that calcium is being depleted from the soil in the Appalachian provinces. Forest productivity and forest species composition are often mentioned as possible concerns related to calcium losses; however, long-term monitoring of forest growth and composition, including calcium-poor sites, does not support these concerns. Estimated losses of soil calcium may be attributed to acid deposition, declining contributions of calcium from atmospheric deposition, and timber harvesting. Losses are buffered by mineral weathering in the soil and some continuing calcium deposition. Biogeochemical modeling reveals that atmospheric deposition, especially $S0_4^{-2}$, had the greatest effect on estimated soil calcium loss, while timber harvesting led to only a slight decrease in exchangeable soil calcium (Solomon et al. 2003). This study was done for the period 1950-2000 for a northern hardwood timber stand. A study in spruce-fir forest also revealed that acid deposition is a more important factor in soil acid-base relationships than timber harvesting (Hornbeck 1992).

Direct effects of timber harvesting are the removal of calcium with forest products. The magnitude of this impact depends mainly on the quantity of biomass removed and the species selected. In general, clearcut harvest that removes the entire aboveground portion of a tree (bole, leaves, and branches) removes the most calcium, while a bole-only clearcut, a thinning, or selective harvest removes incrementally less (Adams et al. 2000.)

Indirect effects may include possible changes in available or exchangeable soil calcium, changes to base saturation levels, and possible impacts on forest health, productivity, or species composition. Biogeochemical modeling suggests that losses in soil exchangeable calcium may occur over a long period of time (Solomon et al. 2003); though plainly, atmospheric deposition is by far the most significant factor. However, actual on-site measurements do not support any change in exchangeable calcium, even with the practice of whole-tree, clearcut harvest. Research at the Hubbard Brook Experimental Forest following a whole-tree clearcut harvest in northern hardwood forest indicates no change in the exchangeable calcium in the first fifteen years (Johnson et al. 1997). Similar results were found in mixed oak forest when comparing both conventional and whole-tree harvest fifteen years after harvest (Johnson and Todd 1998). In fact, it is suggested that deep rooting reserves or non-exchangeable reserves at this mixed oak site probably replenished the exchangeable calcium reserves. More research is being conducted in this arena, and the Forest will continue to monitor findings and recommendations from the scientific community in order to apply appropriate management practices to protect the soil resource.

Direct and Indirect Effects by Alternative

Each of the alternatives has the potential to maintain, alter, or enhance the soil resource to varying degrees. Projects implemented on the Forest under any alternative would require a site-specific assessment of their potential impacts on the soil resource. Forest Plan standards and guidelines are used to help design and implement management activities so that an individual project does not exceed the established thresholds of change to the soil resource.

In general, standards and guidelines are established through consideration of the physical and chemical properties of soil and the needs for management of other resources. All of these factors vary by location across the Forest. Knowledge about the location of sensitive soils can help constrain management activities to protect the soil resource. In some cases, management decisions are made that constrain activities to levels below those allowed by established standards and guidelines to protect other resource values like aquatic or wildlife habitat, scenery, or hydrologic resources. These decisions benefit the soil resource in that it is always desirable to retain more of the natural soil or undisturbed soil on the landscape.

Individual projects are tailored to address the standards and guidelines for soil resource protection in the Forest Plan. Once established, this direction becomes a fixed expectation or criteria for project-level performance and is constraining enough to limit changes to the soil resource to an acceptable level. At the same time, standards and guidelines must also be consistent with the attainment of the established multi-resource goals and objectives stated in the Forest Plan.

Soil Erosion and Sediment

The alternatives present differences in the amounts and types of activities that would potentially occur across the landscape. Some activities would have relatively minor potential to cause noticeable change in the soil resource, while others have the potential to cause very noticeable changes. The actual impacts to the soil resource will vary according to the soil type, the topography, the extent to which the activity disturbs the soil, and the overall watershed condition. The assignment of mitigations may control the magnitude and intensity of impacts permitted across the landscape in some areas. In other areas, other factors such as the presence of highly erosive soils, steep slopes, soil nutrient sensitive soil types, or high levels of water quality concern may play an even greater role in controlling the magnitude and intensity to the degree of soil disturbance on the landscape.

While the specific effect of an individual activity is dependent on many site-specific variables, the overall amount of various activities can be used as a gross indicator of the overall changes that would occur across the soil resource and how those would vary by alternatives. Alternatives with greater amounts of soil disturbance and road construction would, as a general rule; have a greater potential to affect soil productivity. However, system roads and other permanent type activities such as facilities are not included in soil productivity loss according to Regional Soil Quality Standards and Guidelines for estimating soil productivity analyses. These activities are viewed as a permanent commitment of the soil resource. These activities do have associated direct, indirect and cumulative effects but those effects are addressed at the site-specific project level and not at the Forest-wide level. The Roads Analysis Report for the MNF (completed January 2003) provides an assessment of how the road system on the Forest impacts the soil resource.

The following activities are compared by alternative. These activities occur across the Forest to varying degrees and have the most potential to affect soil productivity through soil disturbance and associated erosion and soil movement or loss.

Timber Harvest and Associated Activities - This grouping consists of even-aged harvest, commercial thinning, and uneven-aged harvest when referring to timber harvest. Associated activities include openings for yarding logs and other small-scale disturbances (less than one acre) related to timber removal, skid trails, skid roads, and temporary roads. While there is a wide range of potential effects due to the variability in the intensity of tree removal, generally the change is subtle and does not dominate the landscape. Temporary soil effects generally would occur from ground disturbance and potential logging residue from harvest operations. Short- and long-term effects such as changes in soil nutrient cycling (decomposition rates), changes in soil moisture and changes in soil temperature would occur from a reduction in forested cover density and a more open forested appearance.

Road reconstruction, skid trail development, and temporary road construction all result to varying degrees in soil disturbance. The Forest implements a wide variety of existing road improvement activities under the category of reconstruction. The impacts of these activities vary considerably, and may be negative or positive. Negative effects are associated with newly disturbed soil available for sediment transport, potential destabilization of slopes, and reductions in hydrological flow patterns on the landscape, potentially affecting down slope soil moisture content. Positive benefits include opportunities to address existing non-point source sediment problems, hardening of road surfaces to help reduce sediment production, and opportunities to increase flow away from road beds, minimizing the risk for road bed failure and associated economics costs in repairing roads. Partial road relocation, for example, would have long-term effects similar to road construction. Road widening can also have long-term impacts, though typically not as noticeable as relocation. Other activities—such as bridge repair, culvert replacement, or road graveling—may have minor and temporary effects during implementation, but are designed to improve soil conditions over the long term.

Road Construction – The building of new roads has the potential to create very noticeable long-term alterations in the soil resource. A number of site-specific variables such as elevation changes, soil sensitivity (erositivity rating, wetness, geotechnical characteristics), and cross slopes can influence the degree of impact. Typically road construction produces long narrow openings that allow for a transport of sediment to stream channels and an avenue for soil loss. The density of the road system affects the overall soil productivity of a given watershed. Road densities also affect hydrology as well. Road density and associated effects on the watershed are further discussed in the *Water, Aquatic, and Riparian Resources* section. Although vegetation regrowth may occur on road cut and fill slopes over time, the road prism and associated infrastructure remain unstable and need constant maintenance to minimize soil and associated sedimentation effects to the watershed indefinitely. It is assumed that an unspecified amount of construction would occur in association with timber harvest and that the amount would vary relative to harvest levels by alternative.

Alternative Comparison - Timber harvest numbers in Table SL-1 are estimates from the SPECTRUM model of maximum activity that could occur given certain management constraints (see Appendix B for modeling assumptions and application). These numbers are used for the relative comparison of alternatives, but are not intended to represent actual acres of projected activities.

Table SL-1. Maximum Potential Timber Harvest Acres by Alternative
(Annual averages of acres for the first two decades)

Activity	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Maximum Potential Acres – Conventional Yarding	3,445	2,853	2,826	2,638	3,498
Maximum Potential Acres – Helicopter Yarding	2,296	1,902	1,884	1,759	2,332
Maximum Total Acres Treated	5,741	4,755	4,710	4,397	5,830

Alternative 3 would have the least amount of timber harvest over the next two decades, followed in ascending order by Alternatives 2M, 2, 1, and 4. The risk for soil productivity losses would also be the least for Alternative 3, followed in ascending order by Alternatives 2M, 2, 1, and 4, based on both total harvest acres and conventional methods used to harvest those acres. This risk is associated with harvest activities and their potential effects on soil productivity loss (see General Effects section). The basic assumption is that the more acres of timber harvest activities there are in an alternative, the more potential there is for associated soil disturbance and consequential loss of soil productivity. Overall, there is about a 33 percent difference between the highest amount of acres treated in Alternative 4 and the lowest amount treated in Alternative 3.

Harvest methods were reported separately because the effects of harvesting stands via helicopter cannot be considered on an equal basis with conventional harvesting and road construction. The SPECTRUM model has been adjusted to account for soil sensitivity concerns—such as highly erosive soils, steep slopes, excessively wet soils, and soils prone to mast wasting—by incorporating the assumption that at least 40 percent of timber harvesting would occur with helicopter yarding, which produces very little soil disturbance. This assumption is based on past and current management trends to address other resource concerns at the site-specific level. On-site forest monitoring shows there to be less than 1 percent soil disturbance in harvested timber stands. The soil resource effects of conventional harvesting and road construction have the potential to be more extensive and long term due to increased soil disturbance, and this was modeled to occur in the remaining 60 percent of treated acres.

As mentioned in the Issues and Indicators section, acres of soil disturbance associated with timber harvest is further analyzed in relation to severe erosion potential. An overall assessment of the Forest shows that approximately 80 percent of the Forest has soil types that are rated severe for potential erosion from disturbed soils (NRCS-NASIS database). This uniformity can be explained by the overall consistency of soil types from the sedimentary geology on the Forest and the K factor (measure of erodibility) of the soils formed in this type of geology. On the ground experience, however, has shown that there is considerable variability of erosion potential for soils with a severe rating. There are some soil types on the Forest, such as those that form over Mauch Chunk geology, that are more erodible than others. This personal knowledge is used when planning site specifically at the project level. In addition, some harvest treatments and associated road construction would likely occur in areas with low erosion potential, which would greatly reduce effects.

Because such a high percentage of the Forest is rated with severe soil potential, the acres treated under each alternative would also occur on a high percentage of these soils. Indeed, the percentage of the suitable land MPs (2.0, 3.0, 4.0, 4.1, and 6.1) that occur on soils with severe erosion potential is fairly constant across all of the alternatives, but the amount of acres potentially treated varies. With the highest levels of predicted timber harvest and associated activities (Table SL-1), Alternative 4 would likely have the greatest potential for long-term, short-term, and temporary risk of erosion on soils with severe potential, followed in descending order by Alternatives 1, 2, 2M, and 3.

The risk of erosion needs to be put in proper context. All soils have the potential to erode and move, and soils rated as “severe” have a relatively high potential, all other considerations being equal. Whether and how much the soil actually erodes and moves is influenced by a number of factors. Some of these factors—like climate, topography, and soil type—are beyond the control of the Forest. However, the Forest can influence soil erosion and sedimentation, largely through management activities that disturb and expose soils and that provide conduits (roads, skid trails/roads, fill slopes) for the soil to move downhill toward streams. Forest managers can control these factors to a large extent through practices such as helicopter logging, designated skid trails/roads, stream channel buffers, silt dams, geotextiles, seeding and mulching, and even avoidance in extreme cases. Areas with severe erosion potential can be and have been managed successfully—i.e., without long-term impacts—but that management often involves additional mitigation to protect the soil resource and site-specific layout design to avoid high-risk areas. That mitigation can vary widely depending on local conditions but typically includes some combination of management requirements (as seen in Table SL-2), site-specific mitigation measures determined through project-level analysis, and timber sale contract clauses. These practices are periodically monitored for implementation and effectiveness and can be adjusted as needed for better management in the future. The Forest has an adequate range of mitigation in place to protect ALL soils on the Forest, and that mitigation has been used effectively in the past.

Because mitigation potential is determined spatially on a site-specific basis, it cannot be predicted accurately in a programmatic analysis. However, it is worth emphasizing that, under all alternatives, management standards and guidelines would be used to address potential effects to soils. The Forest-wide mitigation measures in the 2006 Forest Plan would include those listed in Table SL-2.

Table SL-2. Forest-wide Direction for Soil Resource Protection - Soil Disturbance

Standard	SW03	Disturbed soils dedicated to growing vegetation shall be rehabilitated by fertilizing, liming, seeding, mulching, or constructing structural measures as soon as possible, but generally within 2 weeks after project completion, or prior to periods of inactivity, or as specified in contracts. Rip compacted sites when needed for vegetative re-establishment and recovery of soil productivity and hydrologic function. The intent is to minimize the time that soil is exposed on disturbed sites or retained in an impaired condition.
Standard	SW04	Erosion prevention and control measures shall be used in program and project plans for activities that may reduce soil productivity or cause erosion.
Standard	SW05	Maintain at least 85 percent of a vegetation management activity area in a non-detrimentally disturbed condition. Existing system roads and trails, and other administrative facilities within the activity area, are not considered detrimentally disturbed conditions when assessing compliance with this standard.
Standard	SW06	Severe rutting resulting from management activities shall be confined to less than 5 percent of an activity area.
Standard	SW07	The use of wheeled and/or tracked motorized equipment may be limited on soil types that include the following soil/site area conditions: a) <u>Steep Slopes (40 to 50 percent)</u> – Operation on these slopes shall be analyzed on a case-by-case basis to determine the best method of operation while maintaining soil stability and productivity. b) <u>Very Steep Slopes (more than 50 percent)</u> – Use is prohibited without recommendations from interdisciplinary team review and line officer approval. c) <u>Susceptible to Landslides</u> – Use on slopes greater than 15 percent with soils susceptible to downslope movement when loaded, excavated, or wet is allowed only with mitigation measures during periods of freeze-thaw and for one to multiple days following significant rainfall events. If the risk of landslides during these periods cannot be mitigated, then use is prohibited. d) <u>Soils Commonly Wet At Or Near The Surface During A Considerable Part Of The Year</u>, <u>Or Soils Highly Susceptible To Compaction</u>. Equipment use shall normally be prohibited or mitigated when soils are saturated or when freeze-thaw cycles occur.
Standard	SW09	Winter logging is allowed but may only be used where it will meet Forest-wide soil and water quality standards.
Guideline	SW10	Inventory the soil resource to the appropriate intensity level as needed for project planning and/or design considerations.
Guideline	SW11	Soil stabilization procedures should take place as soon as practical after earth-disturbing activities are completed or prior to extended periods of inactivity. Special revegetation measures may be required.
Guideline	SW12	Use Forest-wide soils map(s) and county soil survey report interpretations to help determine soil characteristics and protection needs.

Guideline	SW14	Mulch should be applied on severely eroded areas, or areas with high potential for erosion, such as new road cut and fill slopes.
Guideline	SW15	Topsoil should be retained to improve the soil medium for plant growth on areas to be disturbed by construction. Topsoil should be salvaged from an area during construction and stockpiled for use during subsequent reclamation, or obtained from an alternate site. On some areas, the addition of soil material may be needed to obtain vigorous plant growth. Soil to be used for this purpose should have chemical tests made to determine its desirability for use.
Guideline	SW16	Where the removal of vegetative material, topsoil, or other materials may result in erosion, the size of the area may be limited from which these materials are removed at any one time.
Guideline	SW17	During watershed or project-level analysis, incorporate soil protection or improvement into project planning through an awareness of: a) Soil, geology, and landform conditions; b) The inherent capability of the soils involved; and c) The degree and duration of soil disturbance.
Guideline	SW18	Topsoil or substitute materials used in reclamation should consist of friable soil reasonably free of grass, roots, weeds, sticks, stones, or other foreign material.
Guideline	SW19	Management activities that may result in accelerated erosion and loss of organic matter should have one or more of the following practices applied to mitigate potential effects: a) Limiting mineral soil exposure, b) Appropriately dispersing excess water, c) Ensuring sufficient effective groundcover, d) Stabilizing disturbed soils through revegetation, mulching, or other appropriate means, e) Preventing or minimizing excessive compaction, displacement, puddling, erosion, or burning of soils, and f) Preventing or minimizing the initiation or acceleration of mass soil movement (e.g., slumps, debris flows, or landslides).

The range of direction and mitigation described above should be more than adequate to address soil resource concerns at the project level. Also, a well-defined monitoring plan of implementation has been designed to track and verify predicted effects, and allow specialists to adjust input and mitigation needs for future projects. If monitoring shows that the direction is inadequate, adjustments can be made through Forest Plan amendments and/or changes in management practices.

Acid Deposition

Acid deposition does not vary by alternative. It is a phenomenon that exists across the Forest and begins as an air resource concern. But over time this phenomenon has affected the water resource and aquatic habitat, and recent research has shown that it can also affect soil productivity and quality in certain types of nutrient-poor geologies. The measurable item that does vary by alternative is land allocation and MP in areas assessed to be highly sensitive to the effects of acid deposition. Forty-one percent of the total acreage on the Forest is considered to be of high risk to acid sensitivity. Tables SL-4 through SL-7 show the distribution of those high-risk acres by Management Prescription (MP) for each alternative.

Table SL-3. High-Risk Acid Sensitive Soils by MP for Alternative 1

Management Prescription	Acres of High Acid Sensitivity	Total Acres	% High Acid Sensitivity within MP	% High Acid Sensitivity of Total NF acres
MP 2.0	12,600	13,700	92%	1%
MP 3.0	52,000	137,000	38%	6%
MP 4.0	400	440	91%	0%
MP 5.0	48,300	78,700	61%	5%
MP 6.1	96,800	284,400	34%	11%
MP 6.2	52,500	124,500	42%	6%
MP 6.3	43,100	136,100	32%	5%
MP 7.0	900	1,100	82%	0%
MP 8.0	68,300	130,500	52%	7%
Not assigned	900	9,700	9%	0%

Alternative 1 - The MPs with the highest percentages of high acid sensitivity land are 2.0 (92%), 4.0 (91%), and 7.0 (82%). Together, these areas only comprise about 1 percent of the total NFS land on the Forest. The MPs with the next highest percentages are 5.0 (61%), 8.0 (52%), and 6.2 (42%), all of which would have little or no soil disturbance related to timber harvest or road construction. The lowest percentages fall within MPs that have land that are suitable for timber production: 3.0 (38%), 6.1 (34%), and 6.3 (32%). There are an estimated 148,800 total acres of high acid-sensitive soils in MPs 3.0 and 6.1.

Table SL-4. High Risk Acid Sensitive Soils by MP for Alternative 2

Management Prescription	Acres of High Acid Sensitivity	Total Acres	Percent High Acid Sensitivity within MP	% High Acid Sensitivity of Total NF acres
MP 3.0	68,400	196,900	35%	7%
MP 4.1	85,800	155,700	55%	9%
MP 5.0	48,300	78,700	61%	5%
MP 5.1	21,700	27,700	78%	2%
MP 6.1	89,000	286,600	31%	10%
MP 6.2	36,900	97,500	38%	4%
MP 8.0	24,600	73,600	33%	3%

Alternative 2 - The MPs with the highest percentages of high acid sensitivity land are 5.1 (78%), 5.0 (61%), and 4.1 (55%). MPs 5.1 (Recommended Wilderness) and 5.0 (Designated Wilderness) would have no soil disturbance related to Forest-initiated timber harvest or road construction activities. Although MP 4.1 (Spruce Restoration) has a minor amount of land that is suitable for timber production, most of the high-elevation land in this MP with spruce and spruce-hardwood ecosystems would not be considered suitable timberlands and would receive very little disturbance from harvest or road construction related activities. These high-elevation areas likely have some of the highest concentrations of acid deposition on the Forest. Two of the lowest percentages fall within MPs that have land that is suitable for timber production: MP 3.0

(35%) and MP 6.1 (31%). There are an estimated 157,400 total acres of high acid-sensitive soils in MPs 3.0 and 6.1.

Table SL-5. High Risk Acid Sensitive Soils by MP for Alternative 2 Modified

Management Prescription	Acres of High Acid Sensitivity	Total Acres	% High Acid Sensitivity within MP	% High Acid Sensitivity of Total NF acres
MP 3.0	69,200	195,100	35	8
MP 4.1	85,200	154,500	55	9
MP 5.0	48,300	78,700	61	5
MP 5.1	21,700	27,700	79	2
MP 6.1	87,500	277,600	32	10
MP 6.2	40,200	106,800	38	4
MP 8.0	26,000	76,500	34	3

Alternative 2 Modified - The MPs with the highest percentages of high acid sensitivity land are MPs 5.0 (61%), 5.1 (78%), 4.1 (55%). MPs 5.1 (Recommended Wilderness) and 5.0 (Designated Wilderness) would have no soil disturbance related to Forest-initiated timber harvest or road construction activities. Although MP 4.1 (Spruce Restoration) has a minor amount of land that is suitable for timber production, most of the high-elevation land in this MP with spruce and spruce-hardwood ecosystems would not be considered suitable and would receive very little disturbance from harvest or road construction related activities. These high-elevation areas likely have some of the highest concentrations of acid deposition on the Forest. Two of the lowest percentages fall within MPs that have land that is suitable for timber production: MP 6.1 and 3.0. There are an estimated 156,700 acres of high acid-sensitive soils in MPs 3.0 and 6.1.

Table SL-6. High Risk Acid Sensitive Soils by MP for Alternative 3

Management Prescription	Acres of High Acid Sensitivity	Total Acres	Percent High Acid Sensitivity within MP	% High Acid Sensitivity of Total NF acres
MP 3.0	57,300	183,400	31%	6%
MP 4.1	46,400	90,100	51%	5%
MP 5.0	48,300	78,700	61%	5%
MP 5.1	40,300	99,400	41%	4%
MP 6.1	50,600	177,900	28%	6%
MP 6.2	108,500	225,900	48%	12%
MP 8.0	23,200	60,600	38%	3%

Alternative 3 - The MPs with the highest percentages of high acid sensitivity land are 5.0 (61%), 4.1 (51%), and 6.2 (48%). MPs 5.0 (Designated Wilderness) and 6.2 (Backcountry Recreation) would have little or no soil disturbance related to Forest-initiated timber harvest or road construction activities. Although MP 4.1 (Spruce Restoration) has a minor amount of land that is suitable for timber production, most of the high-elevation land in this MP with spruce and

spruce-hardwood ecosystems would not be considered suitable and would receive very little disturbance from harvest or road construction related activities. These high-elevation areas likely have some of the highest concentrations of acid deposition on the Forest. Two of the lowest percentages fall within MPs that have land that are suitable for timber production: 3.0 (31%) and 6.1 (28%). There are an estimated 107,900 total acres of high acid-sensitive soils in MPs 3.0 and 6.1.

Table SL-7. High Risk Acid Sensitive Soils by MP for Alternative 4

Management Prescription	Acres of High Acid Sensitivity	Total Acres	Percent High Acid Sensitivity within MP	% High Acid Sensitivity of Total NF acres
MP 3.0	72,900	202,900	36%	8%
MP 4.1	106,600	199,800	53%	12%
MP 5.0	48,300	78,700	61%	5%
MP 5.1	0	0	0	0%
MP 6.1	98,400	310,300	32%	11%
MP 6.2	23,800	51,000	47%	3%
MP 8.0	24,600	73,600	33%	3%

Alternative 4 - The MPs with the highest percentages of high acid sensitivity land are 5.0 (61%), 4.1 (53%), and 6.2 (47%). MPs 5.0 (Designated Wilderness) and 6.2 (Backcountry Recreation) would have little or no soil disturbance related to Forest-initiated timber harvest or road construction activities. Although MP 4.1 (Spruce and Spruce-Hardwood Restoration) has a minor amount of land that is suitable for timber production, most of the high-elevation land in this MP with spruce and spruce-hardwood ecosystems would not be considered suitable and would receive very little disturbance from harvest or road construction related activities. These high-elevation areas likely have some of the highest concentration of acid deposition on the Forest. Two of the lowest percentages fall within MPs that have land that are suitable for timber production: 3.0 (36%) and 6.1 (32%). There are an estimated 171,300 total acres of high acid-sensitive soils in MPs with suited timberlands.

Summary – For all alternatives, the areas on the Forest with the highest sensitivity to acid deposition and potential nutrient loss tend to fall in those MPs where little or no regulated timber harvest or road construction would occur. MPs 5.0, 5.1, 6.2, and large portions of MPs 4.1 and 8.0 would provide widespread protection related to the effects of acid deposition by greatly reducing the potential for soil disturbance and removal of soil nutrients.

Alternative 4 would have the most acid-sensitive acres in MPs 3.0 and 6.1, followed by Alternatives 2, 2M, 1, and 3. However, the areas on the Forest with the lowest sensitivity to acid deposition and potential nutrient loss tend to fall in those MPs (3.0, 6.1) where regulated timber harvest or road construction could occur. The relatively low percentages of high sensitivity areas mean that there should be a relatively high percentage of land to manage without potentially affecting soils that are highly sensitive to acid deposition and nutrient loss. On NFS land within MPs 3.0 and 6.1 that is determined to be highly sensitive to acid deposition, additional mitigation would be applied to reduce the potential for soil nutrient loss. This mitigation could include any combination of the management requirements shown in Tables SL-2 and SL-7, as well as site avoidance, which is known to be 100 percent effective.

Table SL-8 shows the Forest-wide management direction of the 2006 Forest Plan that specifically addresses acid deposition and soil nutrient loss concerns.

Table SL-8. Forest-wide Direction for the Soil Resource - Acid Deposition

Standard	SW08	Management actions that have the potential to contribute to soil nutrient depletion shall be evaluated for the potential effects of depletion in relation to on-site acid deposition conditions.
Guideline	SW10	Inventory the soil resource to the appropriate intensity level as needed for project planning and/or design considerations.
Guideline	SW12	Use Forest-wide soils map(s) and county soil survey report interpretations to help determine soil characteristics and protection needs.
Guideline	SW13	Consider liming soils with a surface pH of less than 5.5 on seeding projects, except where there is an objective to maintain acidic ecosystems.
Standard	TR05	Whole-tree yarding shall be prohibited where site-specific soil inventories determine the need for on-site nutrient retention. Whole-tree yarding may be allowed elsewhere based on site-specific management objectives.

On a site-specific basis, there currently is a range of mitigation options available that the Northeastern Research Station has developed for land managers and other researchers have proposed (Horsely et al 2000; Hornbeck 1992; Federer et al. 1989). One expensive but potentially effective option may be watershed-scale liming. Also, adjustments to harvest methods and silviculture prescriptions can reduce potential effects. Longer rotation ages and longer periods between harvest entries can be considered in areas of concern.

As noted above, 2006 Forest Plan direction for soil erosion/disturbance (see Table SL-2) also has beneficial mitigating effects on potential effects from acid deposition/soil nutrient loss. The less soil is disturbed; the more potential there is for nutrients to remain on site. This is why helicopter logging is viewed as a viable means to harvest in the high sensitivity areas.

CFR 219.14 states that land is not suited for timber production if “technology is not available to ensure timber production from the land without irreversible resource damage to soil productivity, or watershed conditions.” It has been suggested that the Forest should remove land from the suitable timber base that is mapped as highly sensitive to acid deposition because harvest-related activities would cause soil nutrient losses that would irreversibly damage soil productivity. The Forest took a hard look at this regulation and determined that removing mapped high acid sensitivity areas from the suitable timber base is not appropriate at this scale or time for the reasons listed below.

The acid sensitivity mapping was done at the Forest-wide scale, based on broad geologic patterns rather than soil types. Past inventories have shown that soil types can vary greatly within any given area, including areas identified as highly sensitive to acid deposition. In order to determine the level of concern related to soil nutrient depletion, soil types and chemistries need to be evaluated site-specifically. The sensitivity map will be validated as site-specific information is gathered.

- The range of management direction and mitigation measures described above should be more than adequate to address soil resource concerns at the project level. The technology exists to mitigate soil nutrient losses and to avoid irreversible damage to soil productivity. The same technologies and mitigation measures have been applied successfully elsewhere on the Forest to address soil erosion and water quality concerns.

- If inventories show that site-specific soil buffering capacity is depleted to the point that the land is unsuited for timber production, it can be removed from the suited base. Land can be designated unsuitable by re-assigning its suitability classification in the timber stand database. This approach would be the same as the one used now to re-assign stands based on slope steepness, inaccessibility, or lack of regeneration potential. These areas would likely be small inclusions within larger areas of suitable land.

- Monitoring for acid deposition (see Chapter IV, 2006 Forest Plan) will track predicted effects and allow specialists to adjust planning and mitigation needs for future projects. If over the life of the plan monitoring shows that direction is inadequate, adjustments can be made through Forest Plan amendments or changes in management practices.

Cumulative Effects

The cumulative effect of applying standards and guidelines and any other additional measures applied would be to keep effects from management activities on the soil resource small in extent and short term or temporary in duration.

Soil Erosion and Sediment

Soil productivity losses for cumulative effects are not calculated for activities being conducted on adjacent private land. Obtaining these numbers would be difficult due to the variability in landowner activities and the absence of any State-wide databases documenting soil disturbance. The Forest is aware that private land activities include timber harvesting, skid road development, grazing, agriculture activities, and residential disturbances that can reduce soil productivity. All of these activities contribute to the overall cumulative effect of decrease in soil productivity within a watershed, but the degree of effect is not known.

In areas of interspersed ownership within NFS land, there is potential for combined effects to the soil resource from Forest activities and those on other ownership land. Development and timber harvest on private land adjacent to the Forest are often accomplished with different objectives than on public land. Harvest types vary on commercial private timberland, and harvest levels generally tend to increase as federal timber supplies decrease, given stable or improving market conditions. In that these harvests may increase with reduced levels of timber sales on NFS land, the potential effects associated with this development are likely to be highest under Alternative 3, and lowest under Alternative 4.

Another recent development trend is the conversion of adjacent agricultural land to rural residences. Private land development trends generally run parallel to national economic trends, and increased with the strong economy in the late 1990s. The development of private land has affected the overall soil quality within watersheds with mixed ownership by decreasing the soil quality and overall soil productivity of the watershed. This development includes utility lines, access roads, timber harvests, residences, and business structures. Some homeowners remove all or some of their trees to provide views. Public desires to live in a rural, mountain environment have resulted in urbanization of some adjacent ownership. Development of agricultural land to rural residences can result in pastoral landscapes changing to rural or, in higher density developments, near-urban landscapes with an associated increase in adverse effects to the soil resource. In some areas, summer home developments are defining the Forest boundaries. These effects are likely to vary under any alternative with the national economy.

Acid Deposition

Cumulative effects are the impact of past, present, and foreseeable future actions, which in this case includes consideration of early land use (forestry and agriculture); long-term changes in atmospheric deposition (SO_4^{-2}, NO_3^- and particulate matter); and future land uses. Early land use information dates to the late 1800s and early 1900s. Future harvesting can be considered for about a 50-year time frame. It is hoped that changes in air quality will continue to improve, and they are expected to improve under current regulations. However, recent modeling predictions show that even with current regulations, some streams would continue to acidify. These predictions also show that chronically acidified streams may not recover after 100 years, even if acidic inputs reach zero (Sullivan and Cosby 2004). Drought and repeated defoliations may also be critical but unpredictable factors, given their role as pre-disposing factors in soil calcium related forest health issues. In other words, this is a classic cumulative effects concern that also points out the complexity and difficulty of measuring environmental changes. For example, while elevated levels of carbon dioxide and nitrite may increase forest productivity, ozone may decrease it. Recent modeling indicates that intact forests may show relatively little evidence of altered growth since pre-industrial times, despite substantial changes in their physical and chemical environment (Ollinger et al. 2002).

Mitigations can be used to delay or temporarily abate the effects of acid deposition but liming of both streams and terrestrial ecosystems is not a permanent solution. Although limestone treatment can alter chemical and biological conditions in a stream so that aquatic habitats are present, the loss of base cations from watershed soils will continue as long as elevated acidic deposition continues and SO_4^{-2} persist in the soil. In a 30-year retrospective look at soil characteristics at specific sites on the Allegheny Plateau, Bailey et al. (2005) discovered that soils at the sites that formed from the underlying Pottsville geology had significant losses of calcium and magnesium that could not be accounted for in biomass accumulation. The only explanation to account for the additional loss of the macronutrients was the leaching and transport of those nutrients off-site. This new evidence may further influence scientists and land managers to believe that acid deposition can have a cumulative effect on the overall long-term productivity of soils. Current data sets from 2003 and 2004 on the Forest further support such conclusions. Eventually the magnitude of potential recovery will be limited by both the magnitude of reductions in sulfur deposition and the magnitude of cumulative long-term damage due to base-depletion in watershed soils (Webb 2004).

Acid deposition is a recognized concern for the Forest. The relationships between air, water and soil chemistry are not always clear; however, science has shown links and associated effects. The results from Forest stream monitoring sites are supported by the acid sensitive geology classification developed by combining data from the US Geological Survey with information on rates of acid deposition from the 2002 Southern Appalachian Mountain Initiative Report (Grim and Lynch 2004). That is, water chemistry monitoring on the Forest indicates a link between poor water chemistry buffering in aquatic systems and contributing watershed areas dominated by geologies classified as higher acid sensitivity, and in some cases dominated by a combination of moderate and higher acid sensitive geologies (Edwards et al. 2004). Soil productivity monitoring is providing additional information that will lead to the ability to model long-term cumulative effects in watersheds. This information will ultimately help land managers answer questions about the potential long-term effects of management activities in highly sensitive areas, and the Forest's ability to achieve future desired conditions.

Management Implications

Implementing Forest programs and activities on sensitive soils is a matter of risk management. The risk to soils cannot be fully assessed at the Forest-wide scale, as we do not yet have the site-specific data needed to appropriately make such an assessment over such a large area. Forest scale mappings of soil erosion potential and acid-sensitive geologies are helpful indicators of relative risk, but this broad-scale and unconfirmed information is inappropriate to use for management prescription assignments, suitability determinations, or project-level decisions. The maps simply cannot account for the variations of soil properties and inherent risk that occur at the site level.

Forest-wide management direction has been designed to provide a range of tools and options to help land managers address risk to soils. However, the magnitude and type of risk still need to be assessed at the project level, based on site-specific soil conditions and proposed activities, before the appropriate tools and options can be determined and applied. Soil Standard SW08 and Guideline SW10 direct land managers to collect the appropriate level of soil information at the project level to help assess risk.

Risk assessments for soils can lead to various management implications, including adjustment of management activities or the addition of site-specific mitigation. For example, timber harvest practices can be modified to take into account areas with low Ca:Al molar ratios. Harvest methods affect the nutrient cycling of the forest floor differently (Elliott and Knoepp, 2005). Methods such as whole-tree harvesting that remove excess organic material have more detrimental effects on nutrient availability than stem-only harvests that leave organic material (branches, leaves, tree crowns) at the harvest site (Elliott and Knoepp 2005). Short harvest rotations also have shown decreases in soil base cations due to the lower accumulation of organic matter and higher soil disturbance (Grigal 2000). Likewise, soil-disturbing activities, including skidding and log yarding, decrease soil productivity by removing soil organic matter and compacting the soil (Berger et al. 2004). Thus, the Ca:Al molar ratio can be used to guide the placement of soil-disturbing activities and determine harvest method and rotation length.

The majority of tree roots occur within 90 centimeters of the surface of the soil, with feeder roots in the upper 60 centimeters (McDaniel 1997; Oettinger 2005). The upper B horizons of the some soils sampled on the Forest were above 60 centimeters in the zone of the feeder roots. The upper B horizon chemistry also has been correlated most strongly with foliar chemistry in sugar maple (Bailey et al. 2004). Therefore, the upper B horizon data can be used for making management recommendations as well.

Because the majority of the base cations in a watershed come from litter fall, soil disturbance and litter removal can be limited in areas of high risk for cation depletion. Harvest methods can leave woody debris and slash material on site to augment nutrient and organic matter input (Mann et al. 1988). Whole-tree harvesting can be replaced by stem-only or sawlog harvesting. An effective way to preserve organic matter on the soil surface is by helicopter or skyline logging. On average, helicopter and skyline logging disturb only 2.5 percent of a site compared to 10 percent or greater for more conventional harvest methods (Grigal 2000).

Harvest rotations in areas of high risk can be extended in order for the base cations in the soil to be replenished (Blanco et al. 2005). Longer rotations have higher percentages of base cation return (Blanco et al. 2005). Soil disturbance can be prohibited or limited on landscape positions that have higher Ca:Al molar ratios. For landscape positions with low Ca:Al ratios--such as the shoulders, benches, and back slope positions--the mitigation costs for forest productivity may be high. Because forest productivity is at the highest risk on these positions, they can be the best places to place skid roads and log landings, because further disturbing these areas would have less effect on productivity than detrimental disturbance on more productive sites. The positions with lower risk tend to have better potential for vegetative growth, and therefore, the soil should not be disturbed (Mann et al. 1988, Grigal 2000).

Due to the variability of the soil conditions across the Forest, site-specific management recommendations cannot be made without a site-specific risk assessment. Although the soil chemistry data set for the Forest is increasing, the density of sampling is not yet sufficient to use the information for project-level decisions. More soil samples will likely need to be taken within project boundaries, with an adequate sample density. Soil sampling can be used in cumulative effects analyses, as the samples indicate past effects and current conditions, and the sampling data can also be used in project design and mitigation to help reduce future impacts. The revised Forest monitoring plan (2006 Forest Plan, Chapter IV) incorporates the probability for such sampling.

In general, areas with a high density of samples that show a moderate or high risk to soils can apply a higher level of mitigation to maintain soil productivity, such as helicopter or sky-line logging. Also, areas with a high density of samples at high risk can be used for placement of skid roads and log landings. On particularly high-risk sites, the Forest has the ultimate option of avoiding management-related disturbance, shifting project activities to safer locales, and removing the site from the suitable timber base.

A possible mitigation for these high risk areas is liming. There have been several research projects focusing on the liming of forest soils. However, the results from these studies have been mixed and many could not be replicated (Rengel 2003). If liming is used for mitigation, there are considerations that should be taken into account. Pelletized lime and limestone sands are the only products that can currently be used in ground spreading equipment (Mizel 2005). The liming materials that have worked the best in the studies have been dolomitic limestone (Rengel 2003), and coarse limestone sands have been found to be more cost efficient than pelletized lime (Mizel 2005). Detrimental effects of liming forest soils have been noted as well. In some studies, liming has been seen to cause leaching of organic carbon and nitrogen from the soil due to increased microbial activity (Rengel 2003). Although liming is a possible mitigation for high risk soils, due to the associated risks and unknowns, more research is likely warranted to help us effectively answer the how, when and where questions related to appropriate application.

The results of ongoing research efforts, both on and off-Forest, will likely play a role in future land management. These findings should provide additional information on the entire issue of soil risk management, ranging from monitoring protocol to mitigation methods. In the meantime, the Forest has direction in its 2006 Forest Plan that is broad and flexible enough to mitigate effects from current management activities and adjust to new science as it becomes available.

Watershed, Riparian and Aquatic Resources

INTRODUCTION

The Monongahela National Forest is home to a wide range of aquatic ecosystems that support a diversity of aquatic organisms and provide a range of services from municipal water supplies to recreation. Protecting the streams, rivers, lakes and springs of the Forest is an important element of the revision process, and a key to protecting water quality and riparian and aquatic communities.

The Monongahela National Forest (MNF) contains the headwaters of five major river systems: the Monongahela, Potomac, Greenbrier, Elk, and Gauley Rivers. Twelve river segments on the MNF are considered eligible for potential inclusion in the National Wild and Scenic Rivers System. There are more than 600 miles of coldwater streams and 350 miles of warm water streams across the Forest. Although the State of West Virginia manages many stream segments as put-and-take trout fisheries with seasonal trout stocking, some estimates indicate that 90 percent of West Virginia's native brook trout streams occur on the MNF.

The recreational fishing opportunities that brook trout and other game fish on the Forest provide have an economic impact of nearly $38 million (American Sportfishing Association 2006). In addition to the recreational opportunities the streams on the Forest provide, much of the water draining National Forest System lands is used for domestic and agricultural purposes by communities both within and downstream of the proclamation boundary. Protecting the headwater streams on the Forest is important for protecting water supplies for many West Virginians.

An important principle in aquatic ecosystem management is the link between aquatic habitat conditions and watershed conditions. Streams are the end result of a number of watershed processes that integrate the flow of water, energy and nutrients, which in turn are products of the watershed's geology, soil, vegetation, precipitation patterns, and other factors. The variability of these processes, both in time and space, creates a diverse and dynamic environment. Aquatic communities depend upon the physical, chemical and biological components of the aquatic ecosystems they inhabit and the watershed characteristics that create those conditions. Because of the relationship between aquatic environments and watershed conditions, the following analysis will be based upon watershed characteristics and the potential for land management activities to affect those characteristics.

Need for Change

In May 2002, a Notice of Intent (NOI) was published in the Federal Register initiating the Forest Plan revision process for the MNF. The NOI identified watershed health as a management emphasis in need of change. More specifically, the NOI stated,

- "Establish management area goals, and standards and guidelines, to improve watershed health in terms of ecological sustainability, including: ecological functions, riparian area management, erosion and sedimentation control, flood and flood damage control, and restoration of aquatic ecosystems."

- "Establish standards and guidelines to mitigate any adverse impacts on watersheds from acid deposition."

These issues were derived from comments received from Forest personnel and the public during the scoping process. Citizens wanted to see a continued emphasis on improving water quality and addressing erosion and sediment on the Forest so as to promote healthy aquatic habitats. Some individuals, organizations, and agencies also wanted to see the Forest address acid deposition, and the effect it is potentially having on Forest resources. In the 1986 Forest Plan, acid deposition was an issue considered but not brought forward due to its scope and the general feeling that the Forest Service did not have the ability to prevent acid deposition. This position has changed and is discussed in greater detail in the *Soil Resource* section.

There are a number of variables and watershed conditions that influence the health of aquatic ecosystems in the analysis area. Land management activities can affect the natural characteristics of aquatic ecosystems and alter their aquatic resource potential. Today, due to historic logging activities and contemporary pressures such as timber harvesting, roads and acid deposition, most of the streams on the MNF are under stress and their productivity is reduced. Factors contributing to the impairment include elevated levels of fine sediment, acid deposition, impacts to riparian vegetation, and passage barriers that reduce habitat availability and isolate populations.

A wide range of activities permitted under the Forest Land and Resource Management Plan can contribute to these impairments. The land management activities that are the greatest concern to watershed, riparian, and aquatic resources are timber harvesting and roads. At a Forest-wide analysis scale, soil and watershed disturbances associated with timber harvesting and road management account for the largest acreage of soil and vegetation disturbance. Unlike other programs that remain relatively constant through the alternatives, the area of potential timber harvest varies between alternatives and can be used to evaluate differences between alternatives. Disturbances related to recreation sites, grazing allotments, mineral development, watershed restoration and other programs occur but tend to be localized and are difficult to assess at the landscape scale. Likewise, the benefits incurred from watershed, riparian, and aquatic habitat improvements are also localized and better addressed at the site-specific project planning scale. Therefore, the emphasis of this analysis will be on the potential effects of timber and road management activities on watershed and aquatic conditions, while the direct, indirect and cumulative effects of other management programs will be addressed in more detail during project planning and evaluation.

Issues and Indicators

Issue Statement

Forest timber management strategies may affect watershed, riparian and aquatic resources.

Background to the Issue

Timber harvest and connected actions have the potential to affect a number of watershed processes. The removal of timber, the type of logging method used and the associated transportation system all have the potential to affect watershed, riparian and aquatic conditions to varying degrees. The potential risk of these activities is dependent upon the scope of the action, the existing site conditions and the effectiveness of the mitigation measures used. Because the amount and distribution of timber harvest varies by alternative, it can be used to show the relative differences in the potential impacts related to:

1) Soil erosion and sedimentation effects on aquatic ecosystems,
2) Soil nutrient and base cation depletion and soil acidification related to acid deposition,
3) Water quality and quantity, and
4) Channel and floodplain modifications.

Indicators

The following indicators will be used to reflect the differences between alternatives and the potential risk to watershed, riparian and aquatic resources.

- Acres of Management Prescriptions that allow commercial timber harvest by alternative

This indicator sets the location for potential timber management activities. Alternatives differ by their allocation of management prescriptions across the Forest watersheds, and to what degree, they may be affected. The fifth level watershed layer was overlaid with management prescriptions that have lands considered suitable for timber production to identify the potential treatment areas. This overlay identified the range of watersheds that are potentially affected by timber management activities and, in turn, the species of concern that are potentially affected in those watersheds. Not all of the acres within the management prescriptions are available for harvesting. Resource protection measures, such as riparian buffers or West Virginia Northern Flying Squirrel habitat, reduce the overall acres that are available for harvest.

- Acres, volume, and methods of potential timber harvest by alternative

A key management objective for vegetation is to have better distribution of forest age classes through time. Timber harvesting is the primary management tool proposed to achieve the desired age class distribution. Using the Spectrum model, different management strategies, which form the basis of the Forest Plan alternatives, are run for a 150-year period to achieve the vegetative management objectives. Modeled outputs that potentially affect watershed and aquatic processes include the total acres treated, the volume of timber harvested, and the type of harvest method used. Possible effects include reducing the recruitment potential of large woody debris (LWD), affecting stream flows, reducing stream shading, and contributing to nutrient and base cation depletion on acid sensitive geologies. It is assumed that the more acres treated, the greater the risk to watershed, riparian and aquatic conditions.

The type of logging method used also has implications for potential impacts to watershed and aquatic conditions. The Spectrum model differentiates between acres treated using helicopter logging and acres using conventional, ground-based logging systems. The potential for soil disturbance in conventional units is much greater than helicopter units. The assumption is the greater the level of ground disturbance, the greater the potential for impacts associated with erosion, sedimentation, soil nutrient loss, and modified runoff patterns. Conventional logging may also require more roads than helicopter logging in order to access remote units. Potential road-related impacts include ground disturbance, sedimentation, modified runoff patterns, channel and floodplain modifications, and aquatic passage barriers. The numbers generated by the Spectrum model are used as a relative comparison of alternatives, and are not intended to represent actual acres of projected activities.

Scope of the Analysis

The scope of the analysis is the potential direct, indirect and cumulative effects of management activities on NFS lands. The primary focus will be management prescriptions that allow timber harvesting activities. These are the management prescriptions with the greatest potential to affect watershed, riparian and aquatic conditions. Potential direct and indirect effects will be discussed for activities on NFS lands and the fifth level watersheds in which they occur. The potential cumulative effects area consists of the fifth level watersheds within the proclamation boundary, including activities on state and private lands. The analysis in this report was conducted on 31 of the 44 watersheds (fifth-level hydrologic units) that contain lands managed by the MNF. Nine of the 44 watersheds were omitted from the analysis because NFS lands comprise less than 0.85 percent of the watershed area. Four of the remaining 35 watersheds were combined with adjacent watersheds of similar form and function to address watershed size and to simplify the analysis process.

CURRENT CONDITIONS

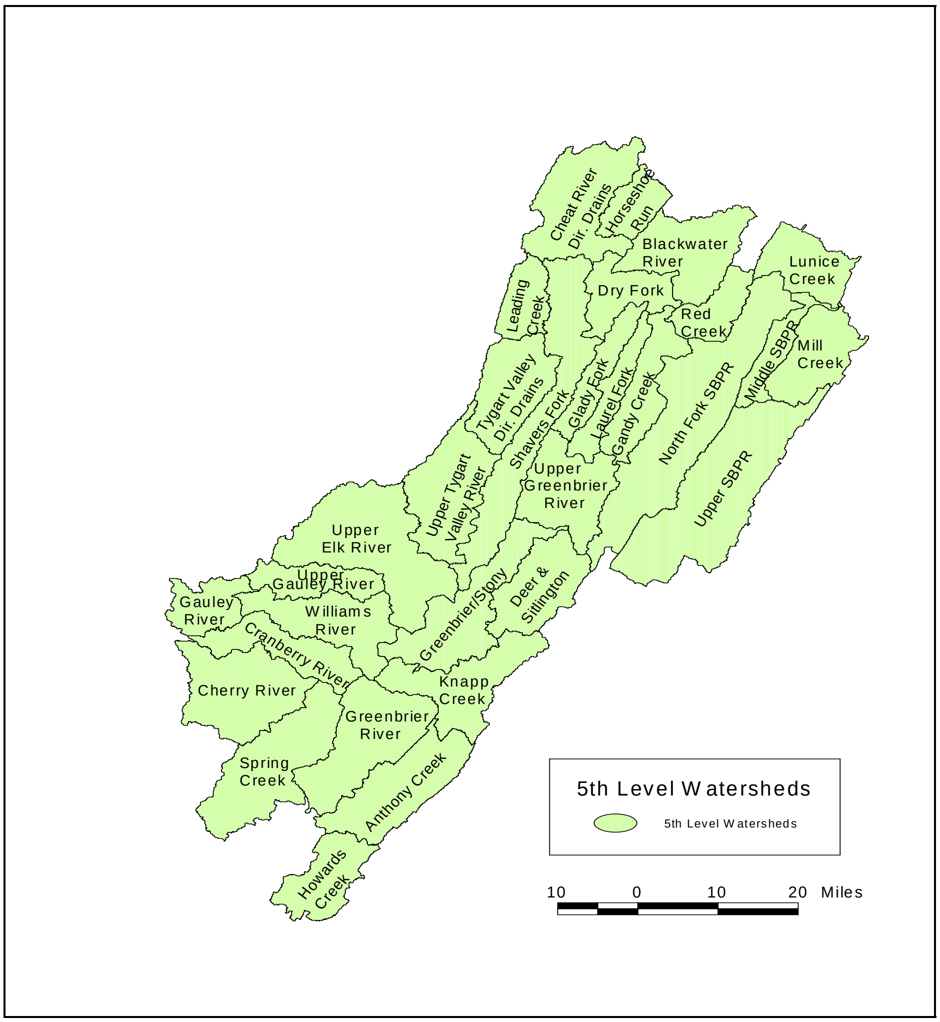
Existing Conditions on the MNF

Watershed Characteristics

The MNF is located in the east-central portion of West Virginia among the Ridge and Valley and Allegheny Mountains Geographic Regions. The MNF lies within 44 fifth-level watersheds (Figure 1) nested within 6 different fourth-level sub basins, including the Cheat River, Elk River, Gauley River, Greenbrier River, Tygart River, and South Branch Potomac River. The fifth-level watersheds average 130 square miles (83,000 acres) with a range of 52 to 317 square miles (33,000-203,000 acres). The watersheds fall within two major hydrologic regions, with five watersheds draining through the Potomac River to the Atlantic, and 39 draining through the Ohio and Mississippi Rivers to the Gulf of Mexico.

National Forest ownership is important in Forest watershed-based planning because it determines the degree of influence the MNF will have in any particular watershed. The Forest can have the greatest influence on those watersheds with a high percentage of NFS land. NFS ownership within the 31 fifth-level watersheds ranges from 1.3 to 97.3 percent. There are 18 watersheds with more than 25 percent NFS ownership and 12 of these have more than 40 percent NFS ownership. The Forest could have a considerable influence on the condition of these 18 watersheds through our management actions and collaboration with others. Seven watersheds have 15 to 25 percent NFS ownership. In these watersheds the Forest could have an important influence through collaboration with other agencies and citizen groups, particularly in key subwatersheds with substantial NFS ownership. In the three watersheds with 5 to 15 percent NFS ownership, the MNF would affect conditions through collaboration with other agencies that take the lead role in assessment and management. Three watersheds have less than 5 percent NFS ownership. Within these watersheds, the ability of the MNF to affect or influence conditions is generally limited to sixth- or seventh-level subwatersheds with substantial NFS ownership.

Figure WA-1. 5th Level Watersheds Overlapping the Monongahela National Forest



Watersheds can be characterized by their natural features such as soils, geology, and topography, and by management-related features such as road densities, road crossings, or ownership patterns. A few key characteristics related to watershed and aquatic health issues are included in Appendix E. An important element of watershed condition is the highly erosive soils found throughout the analysis area. An average of 79 percent of the NFS lands within the fifth-level watersheds is classified as highly erosive due to soil types and topography. The most highly erosive parent geology, Mauch Chunk, is found in 16 of the watersheds in amounts ranging from 2 to 59 percent of NFS lands. Thirty of the thirty-one watersheds have varying degrees of acid sensitive geology. Leading Creek is the only watershed that does not have some acid sensitive geology on NFS lands. This is due in part to the relatively small piece of the watershed that is within the proclamation boundary and part of the Forest.

Water Quality

Water chemistry of streams and rivers is the by-product of dynamic nutrient pathways and chemical processes occurring within the contributing watershed environment—atmospheric, terrestrial, and biological. The significance of water chemistry is perhaps no more apparent than in aquatic ecosystems composed of diverse geology, particularly when these systems are exposed to acid deposition. Watersheds across the MNF are composed of a wide range of surface geologies that have variable capacities for neutralizing acid inputs.

Healthy, reproducing trout populations and their associated communities have various habitat requirements. Water quality in rivers and streams is an important consideration when establishing management priorities on the Forest to provide for the maintenance of healthy aquatic ecosystems. Water chemistry is one component of water quality and represents a fundamental building block for aquatic communities. For example, harmful effects to certain aquatic organisms begin to occur as pH values in streams fall below 6.0; detrimental effects occur to most aquatic organisms as pH falls below 5.0. Also, values less than 50 for acid neutralizing capacity (ANC) indicate a stream system is acid sensitive, values less than 25 suggest a system likely experiences episodic acidification during storms, and negative ANC values indicate a system is already acidic (http://www.dep.state.wv.us).

In 2001, the MNF initiated an effort to establish Forest-wide monitoring of water chemistry properties in streams across the Forest. Sample sites were strategically located to allow monitoring efforts to increase the level of understanding of the relationships between water chemistry and various local environmental factors, including the geologic composition of contributing watershed areas, rates of acid deposition, and supported aquatic communities. Results of water chemistry monitoring from fall low flow and spring high flow sampling across the Forest demonstrated a high degree of variability between sample locations and sample periods, as expected. For example, measures of pH ranged from 3.88 to 8.2 (mean = 6.8) during fall 2001 samples (low flow conditions) and from 3.73 to 8.55 (mean = 6.4) during spring 2002 samples (high flow conditions). Measures of ANC ranged from -166 to 2,868 (mean = 407) during fall 2001 samples and from -195 to 1,599 (mean = 135) during spring 2002 samples.

Variation in measures of pH and ANC between sample locations was largely explained by the variable capacity of a watershed's geology to neutralize acid inputs. Variation in measures of pH and ANC between sample periods at a given site was largely explained by the different stream discharge conditions. Except where acid mine drainage is an issue, water samples collected at low flow conditions during the late summer to early fall period typically exhibit higher pH and ANC values due to the greater influence of groundwater on stream flows as compared to spring high flow conditions when direct inputs from melting snow and precipitation (i.e., acid rain) have greater influence.

State water quality monitoring programs are also documenting cases of stream acidification in West Virginia. In an attempt to mitigate impacts of stream acidification on native trout streams and the recreational fishing opportunities they provide, the State has developed and refined a program to treat acid impaired streams with limestone sand. Limestone sand is currently being applied to acid-impaired streams on the Forest and across the State to help neutralize acidity. Forest monitoring results show water chemistry downstream from treatment areas exhibit notable increases in ANC, pH, and Ca when compared to untreated water upstream. Although this action helps to mitigate many symptoms of stream acidification within the effective stream treatment zone, it does not affect the underlying cause of the condition to address risks to aquatic and terrestrial ecological processes and functions that extend beyond the treatment zones (McClurg, et al. 2004).

Section 303(d) of the Clean Water Act requires each state to periodically submit to the Environmental Protection Agency (EPA) for approval a list of impaired waters that do not meet state water quality standards. The West Virginia Department of Environmental Protection last submitted an updated list to EPA in November 2004 (WVDEP 2005). EPA approved the list of impaired waters in December 2004. Table WA–1 displays the total number of impaired stream miles within the Forest Proclamation Boundary.

Table WA-1. Stream Miles within the Forest Boundary on the 2004 303(d) List

Impairment	Within Proclamation Boundary	On NFS Lands
Aluminum (dissolved)	326 miles	122 miles
Benthic Macro-invertebrates	62 miles	27 miles
Fecal Coliforms	39 miles	1 mile
Mercury	159 miles	28 miles
pH	172 miles	126 miles

In all, an estimated 630 miles of stream within the proclamation boundary are on the current 303(d) list and 250 miles are on NFS lands. The miles shown in Table WA-1 total more than 630 and 250 respectively because stream miles may be counted more than once if they do not meet water quality standards for more than one criterion. The impaired streams occur in twenty-one watersheds within the Forest proclamation boundary. On NFS lands, impairments due to dissolved aluminum, mercury and pH are likely closely related to the effects of acid deposition, and to a much lesser extent acid mine drainage. The effects associated with typical forest management activities would generally be nonpoint sources of pollution, but can contribute to the benthic macro-invertebrate impairment. In the case of nonpoint sources of pollution, best management practices (BMPs), riparian buffers, and watershed and fish habitat improvement projects are used to help protect and restore desired conditions.

It should be noted that not all streams on the Forest have been sampled. If a stream does not show up on the 303(d) list, it may be because it either fully meets the water quality standards for its designated uses, or it may be because it has not been sampled. We do not assume that streams not on the list are currently meeting water quality standards. The West Virginia Department of Environmental Protection (WVDEP) website identifies those streams that are in compliance, called Category 1, and those that have insufficient data to determine compliance, called Category 3 (www.dep.state.wv.us). This website also includes the scheduling for developing Total Maximum Daily Load (TMDLs) to address streams listed as impaired.

Aquatic and Riparian Habitat

There are an estimated 600 miles of coldwater streams, 350 miles of warm water streams, and 216 acres of impoundments on the Forest. The coldwater streams on NFS land include 384 miles of native/wild trout streams, 186 miles of stocked trout stream, and 30 miles of trout stream which have not been differentiated as native/wild or stocked (USDA Forest Service 1990).

Aquatic and riparian habitats within the MNF proclamation boundary are still heavily influenced by historic impacts associated with agricultural developments and logging. Simplified channel conditions and elevated levels of fine sediment are a legacy of past land use activities and contemporary disturbances. Extensive clearcutting and burning during the late 1800s and early 1900s removed trees adjacent to stream channels that were the source of LWD. These activities that occurred prior to the area becoming a national forest have resulted in the existing low levels of LWD in stream channels, and stream environments that generally lack adequate pool habitat and hiding cover. Today, the riparian forests are maturing and natural recruitment of LWD is expected to increase as trees die and fall into the stream channels. This in turn will begin to restore the function of LWD within the watershed and improve the health of the aquatic environment. Protecting riparian buffer strips along stream channels is important for retaining the source of future LWD recruitment. Opportunities also exist to actively add wood to stream channels to facilitate recovery.

Large woody debris is important for a number of functions in perennial, intermittent and ephemeral channels. In perennial streams LWD increases habitat complexity by scouring pools, trapping spawning gravels, provides hiding cover, and helping to dissipate stream energy. In intermittent and ephemeral channels LWD helps to trap and store sediment in the watershed, provides structure for channel stability, and helps retain moisture (Duncan et al. 1987, Hicks et al. 1991, Flebbe and Dolloff 1995).

Stream surveys on NFS lands from 1996-1998 reveal the effect of LWD absence. The most common channel type of the stream reaches inventoried was “plane bed”. Plane bed reaches are generally featureless, with limited habitat complexity. Of the 670 stream reaches that were inventoried, 293 (44%) were classified as plane bed (data on file at the MNF Supervisors Office). The remaining reach types were cascades (15%), bedrock (12%), beaver (8%), pool-riffle (8%), step pool mix (7%), and pool-riffle mix (5%). The amount of plane bed reaches should decrease as riparian forests continue to mature and LWD increases. Through time this will improve pool development and result in more step pool and pool-riffle reaches.

Past and present land management activities have resulted in streams with levels of fine sediment that may impair aquatic productivity. Fine sediment can adversely affect aquatic communities by reducing habitat quantity, habitat quality, water quality, and food supplies (Waters 1995). Sediment sampling has been conducted on the MNF to assess the potential impacts of fine sediment (less than 4 millimeters in size) on trout productivity. Potential spawning gravels are sampled and decreased trout productivity can occur when levels of fine sediment exceed 20-25 percent of the sample. Of the 222 spawning gravel samples collected on NFS lands from 1994-1999, 142 (64%) exceeded 20 percent fine sediment (data on file at the MNF Supervisors Office).

There are no natural lakes on the Forest, but there are four major impoundments: Summit Lake (43 ac.), Lake Buffalo (22 ac.), Sherwood Lake (43 ac.) and Spruce Knob Lake (25 ac.). These impoundments were built in the early 1970s primarily to provide recreational opportunities. Other than routine maintenance and safety inspections, there is minimal operation of the dams. No water is diverted or utilized from the reservoirs, and essentially what flows into the reservoir flows out. Downstream flows are not controlled unless the pools are drawn down to work on the dam, or, in the case of Summit Lake, to supplement water supplies for Richwood during dry years. Management of the dams is carried out under the authority and limitations of various laws and regulations (see Forest Service Manual – FSM 7500).

Given the steep and rolling topography of the Forest, wetland development is relatively limited. Less than 1% (approximately 5,000 ac.) of NFS lands are identified on the National Wetlands Inventory. Approximately 15,000 acres are identified within the proclamation boundary. Wetlands can range in size from small seeps to large open water wetlands. Many of the larger identified wetlands on the Forest are protected as Botanical Areas and/or National Natural Landmarks. Protection has also been provided to wetlands through management direction in the 2006 Forest Plan (see SW30, SW31, SW51, SW57, VE32, RA18, MG32, MG33, LS04, and RF06 in Chapter II).

Aquatic Biota/MIS/Species Viability

The National Forest Management Act (NFMA) requires that aquatic habitat "be managed to maintain viable populations of existing native and desired non-native vertebrate species in the analysis area" (36 CFR 219.19). Viable populations are considered to be those populations that have the numbers and distribution of reproductive individuals to ensure their continued existence in the analysis area.

The MNF straddles the divide between the Mississippi River basin and the Atlantic slope, and forms the headwaters of several major river systems. The location of the Forest, in the central Appalachians, has influenced stream characteristics and the evolutionary pathways of aquatic communities. The result is fairly high aquatic diversity on the Forest, with species that may be unique to either side of the divide and species that are common on both sides.

Overall, the streams and rivers on the Forest support 87 species of fish as well as numerous species of invertebrates including insects, mollusks, and crayfish. Fish species are predominantly native, non-game species. Appendix E displays a list of fish species that have been reported in the fifth-level watersheds that drain the Forest.

Species abundance and diversity in the analysis area today has been shaped, in part, by past land use activities. As the analysis area was settled and floodplains and riparian areas were utilized for agriculture, home sites and transportation systems, changes to aquatic ecosystems began to occur. Declines in fish populations were noted in the Potomac and Cheat River systems as early as the mid-1800s (Kinney 1958).

Large-scale modifications to streams, riparian areas and watershed conditions began in the late 1800s with logging, railroading, roads, and fires resulting in significant soil losses and loss of riparian vegetation. Within the area that is now the MNF, we can speculate that as timber harvest activities intensified, stream conditions became less favorable for native species that prefer cold, clean water and more favorable for species that are tolerant of warmer water temperatures and increased sediment loads. The disturbance probably resulted in an expansion in the range of cool and warm water communities within the proclamation boundary, while coldwater communities retreated into the higher, headwater streams. Moring et al. (1994), for example, observed a similar shift in species composition due to timber harvesting along a brook trout stream in a northeastern spruce-fir community in Maine. A reduction in streamside canopy and shading resulted in the disappearance of brook trout from the affected area and an increase in non-game species such as common shiner, northern redbelly dace, and white sucker. It is likely that fish communities in the analysis area today are, in part, a relic of the impacts that occurred with the historic logging. Even though forests and riparian areas are recovering, the recovery of aquatic conditions and fish communities is lagging. This is consistent with a study in North Carolina where researchers found that one of the best predictors of current aquatic diversity of the study streams was land use patterns in the 1950s (Harding et al. 1998). This legacy continues to influence the pattern of diversity in the analysis area, and it is unclear what implications it has on aquatic species viability as systems continue to recover and transition on a landscape scale, while localized and cumulative impacts continue to occur.

Aquatic Species Viability

There are a number of variables that influence the distribution and viability of aquatic species on the Forest. Habitat quality, habitat quantity, accessibility, water quality, and biological factors such as the presence of non-native species can all affect the range and abundance of aquatic species. The variables that are addressed here are those that are specific to Forest management activities. The primary concerns associated with land management activities are 1) increased sedimentation from ground-disturbing activities, 2) elevated stream temperatures due to reduced riparian vegetation and stream shading, 3) decreased habitat conditions and channel stability due to reduced recruitment of large woody debris, modified flow conditions, or modified channel and floodplain morphology, and 4) fragmentation of habitat and isolation of populations due to passage barriers associated with road crossings. In addition to these land management factors, much of the MNF is underlain by geologies that are sensitive to acid deposition, and streams within watersheds with poorly buffered geologic types are susceptible to acidic conditions. Acidification is happening independent of Forest land management activities, but the concern is that the removal of nutrients and base cations from areas with acid sensitive geology could potentially contribute to cumulative impacts.

The process to determine aquatic species viability is to link the aquatic species on the Forest to the watersheds they inhabit, and then determine the potential for changes in aquatic habitat conditions related to land management activities, and the vulnerability of the species to the potential changes. More specific information regarding the species of concern and the methodology used to determine their viability can be found in the *Aquatic Species Viability Report, Monongahela National Forest, 2005*.

First, a comprehensive list of aquatic species with potential viability concerns was compiled for the MNF. Data from the West Virginia Division of Natural Resources, the Heritage Database, *Fishes of West Virginia* (Stauffer et al. 1995), and other sources were used to identify aquatic species within the Forest boundary and the fifth-level watersheds they inhabit. Species were considered to have viability concerns if:

- They are on the Regional Forester's Sensitive Species (RFSS) list,
- They have a global (G Rank), national (N Rank) or state (S Rank) status of 1-3,
- The species has a limited distribution within the analysis area and is considered locally rare.

No federally listed aquatic species occur within the MNF proclamation boundary, but 10 aquatic species are currently on the Regional Forester's Sensitive Species (RFSS) list, 7 fish, 2 mollusks and 1 amphibian. In addition to the species identified on the RFSS list, there are aquatic species of concern with G, N, or S rankings of 1, 2 or 3, that have been collected within the proclamation boundary, including 14 fish and 2 crustaceans (see Appendix E).

For the purposes of this analysis, locally rare species are considered to be those species that are reported in less than five fifth-level watersheds in the analysis area. Fish are the only faunal group that has this designation because of the extensive sampling data and distribution information that was available. Species in other faunal groups are listed based on their presence on the RFSS list or their G, N, or S rank.

The data used to generate the comprehensive species list came from a variety of sources and sampling efforts throughout the proclamation boundary. Given the differences in sampling techniques, sampling efficiency, and sampling locations, the comprehensive list basically represents species that have been reported in the analysis area and when they were reported. Without rigorous and routine sampling information, the data cannot be aggregated to accurately assess species abundance or population trends. As a result, rather than a numerical analysis, the determination of population viability is a general assessment of the vulnerability of the species to potential disturbances associated with Forest Plan management strategies.

Literature was reviewed to identify the vulnerability of each species to the variables that might change due to potential land management activities. Detailed information on habitat requirements was often lacking, so assumptions were made based on the species life history. The following assumptions were used to evaluate species vulnerability:

- Sedimentation: Benthic organisms, or life stages, are susceptible to sedimentation and the filling of interstitial spaces that affect habitat and food supplies.

- Water temperature: Coldwater species are more sensitive to changes in stream temperature than cool or warm water species.

- Habitat complexity: Species that prefer pool habitat are more sensitive to loss of channel structure and habitat complexity than riffle and run dwelling species. LWD plays a greater role in forming habitat in smaller headwater streams than in larger main stem systems, so species occupying headwater streams are more sensitive to losses of LWD.

- Passage barriers: Road crossings on small streams are more likely to create passage barriers and reduce the habitat available to headwater species than crossings on larger main stem rivers. Road crossings pose a greater problem to species that migrate or move than those with limited home ranges.

- Acid deposition: At times, the literature referred specifically to a species' sensitivity to acidic conditions. These species have been identified as being acid sensitive, when in actuality all species are susceptible to low pH levels. We also assumed that species in headwater streams are generally more susceptible to acidic conditions than species inhabiting main stem rivers with broad drainage areas.

Overall, the potential of the Forest to influence population viability, either positively or negatively, is generally greater in headwater streams than the larger main stem rivers. Headwaters streams are usually in closer proximity to Forest management activities, and the relative influence of management on NFS lands typically decreases as the drainage area increases downstream.

It is also assumed that the potential influence of Forest management activities on species that are tolerant of a wide range of conditions is probably negligible. In these cases, some other variable, such as a biologic control, may limit populations. Table WA–2 displays the species of concern and the potential effects related to land management activities to which they are vulnerable. These effects include sedimentation, water temperature, habitat complexity, passage and acid deposition.

Once the vulnerabilities for the species were identified, the next step was to determine the likelihood that management activities on NFS lands could affect the vulnerabilities. Given the direction for riparian buffers along perennial, intermittent and ephemeral channels in the 1986 and 2006 Forest Plans, the likelihood that management activities would affect stream shading or large woody debris recruitment is low. Species vulnerable to changes in water temperature and habitat complexity are not likely to be affected through the alternatives. Localized effects may occur, but at a programmatic scale, these should be relatively minor and can be minimized or mitigated at the project level.

Table WA-2. Aquatic Species of Concern and Factors that Potentially Effect Population Viability

Species	State S Rank	Species Vulnerability Factor				
		Sediment	Temp.	Habitat Complexity	Passage	Acid Dep.
FISH						
American eel (Anguilla rostrata)	S2					
Appalachia darter (Percina gymnocephala)*	S3	X		X		
Banded sculpin (Cottus carolinae)	S2	X				
Bigmouth chub (Nocomis platyrhynchus)	S3S4	X				
Bluebreast darter (Etheostoma camurm)	S3	X				X
Bluehead chub (Nocomis leptocephalus)	S3					
Candy darter (Etheostoma osburni)*	S2	X				
Cheat minnow (Rhinichthys bowersi)*	S1S2			X		X
Common shiner (Luxilus cornutus)	S3					
Creek chubsucker (Erimyzon oblongus)	S3	X			X	
Kanawha minnow (Phenacobuus teretulus)*	S1	X				X
Longhead darter (Percina macrocephala)	S2	X		X	X	
Mountain redbelly dace (Phoxinus oreas)	S3			X	X	
New River shiner (Notropis scabriceps)*	S2		X			X
Pearl dace (Margariscus margarita)*	S3S4		X	X	X	
Popeye shiner (Notropis ariommus)	S2	X				
Potomac scuplin (Cottus girardi)	S3	X				
Redside dace (Clinostomus elongatus)*	S1S2	X	X		X	X
Tesselated darter (Etheostoma olmstedi)	S2	X				
Tonguetied minnow (Exoglossum laurae)	S3	X				X
Torrent sucker (Thoburnia rhothoeca)	S3	X			X	
Black redhorse (Moxostoma dusquensnei)	S4	X	X	X	X	
Brindled madtom (Noturus miurus)	S4	X		X	X	
Logperch (Percina caprodes)	S5	X		X		
Longear sunfish (Lepomis megalotis)	S5	X		X		
Pumpkinseed sunfish (Lepomis gibbosus)	S5	X		X		
Rosefin shiner (Lythrurus ardens)		X				X
Spottail shiner (Notropis hudsonius)	S4			X		
Spotted bass (Micropterus punctulatus)	S5			X		
Yellow bullhead (Ameiurus natalis)	S5					
AMPHIBIAN						
Eastern Hellbender (Cryptobranchus alleganiensis)*	S2	X	X			X
INVERTEBRATE						
A Crayfish (Cambarus monongalensis)	S3			X		
New River Crayfish (Cambarus chasmodactylus)	S3	X				
MOLLUSK						
Elktoe (Alasmidonta marginata)*	S2	X		X		X
Green Floater (Lasmigona subviridis)*	S2	X		X		

*Regional Forester's Sensitive Species

Opportunities also exist to restore impaired conditions to increase riparian vegetation, stream shading, and channel structure over existing conditions. Although the potential effects to stream temperatures and habitat complexity are low on NFS lands, population viability within the analysis area could still be affected by potential impacts from activities on state and private lands.

The likelihood that management activities on NFS lands could affect sedimentation, passage, and potentially contribute to stream acidification is largely associated with the potential effects of timber management and the transportation system on the Forest. At a programmatic scale, timber management and roads have the potential to affect watershed, riparian and aquatic conditions across the Forest, which in turn can potentially affect population viability.

Population viability outcomes were determined for each species of concern for each watershed in which they occur (Appendix E). The viability outcomes were primarily determined by the frequency of occurrences within the WVDNR and Heritage Database sampling records, and the potential for land management activities to affect conditions on which the species depend. The potential effect takes into consideration the existing watershed conditions, ownership patterns, and management direction for NFS lands within the watersheds. The following are the possible viability outcomes:

Outcome A. The species is generally common and the potential effects from land management activities are low due to management prescriptions, watershed characteristics or species tolerance.

Outcome B. Species is generally common within the watershed and management activities can potentially affect one or more of the species vulnerabilities. NFS lands represent more than 50 percent of the watershed area within the proclamation boundary increasing our potential influence on population viability.

Outcome C. Species is generally common within the watershed and forest management activities can potentially affect one or more of the species vulnerabilities. NFS lands represent less than 50 percent of the watershed area within the proclamation boundary reducing our potential influence on population viability.

Outcome D. Species occurrence is rare within the watershed and stochastic events (accidents, weather events, etc.) may place persistence of the species within the watershed at risk. Potential effects related to forest management activities are low due to management prescriptions, watershed characteristics, or species tolerance.

Outcome E. Species occurrence is rare within the watershed and stochastic events (accidents, weather events, etc.) may place persistence of the species within the watershed at risk. Management activities can potentially affect one or more of the species vulnerabilities. NFS lands represent more than 50 percent of the watershed area within the proclamation boundary, increasing our potential influence on population viability.

Outcome F. Species occurrence is rare within the watershed and stochastic events (accidents, weather events, etc.) may place persistence of the species within the watershed at risk. Management activities can potentially affect one or more of the species vulnerabilities. NFS lands represent less than 50 percent of the watershed area within the proclamation boundary, reducing our potential influence on population viability.

It should be noted that the term "watershed" used in the context of the viability outcomes, refers to the portion of the fifth level watershed within the proclamation boundary, including NFS, state and private lands. This represents the area for potential direct, indirect and cumulative effects that might influence species viability within the planning area.

An assumption inherent in the determination of population viability outcomes is that a viable population currently exists. Often, this could not be confirmed using the available information. If a species was reported within a watershed, the assumption was other individuals exist and habitat conditions occur within that watershed to support a viable population. A species was considered to be "generally common" if it had been reported in the watershed more than five times and had been observed in the watershed within the past 10 years. In some cases, Stauffer et al. (1995) reported species within watersheds but there was no record of them in the WVDNR or Heritage databases. Or, species had been collected within the watershed, but the last reported collection was more than 10 years ago. In these cases, the species occurrence is considered rare within the watershed.

Management Indicator Species (MIS)

Aquatic MIS are used as bio-indicators to assess the effects of Forest management activities on the health of aquatic ecosystems. The concept of MIS suggests that the status and trend of one or more key species provide insights as to the integrity of the larger ecological system to which it belongs. MIS serve an umbrella function in terms of encompassing habitats needed for many other species, playing a key role in maintaining community structure or processes, being sensitive to the changes likely to occur in the area, or otherwise serving as an indicator of ecological sustainability. The 1986 Forest Plan identifies wild trout as the sole MIS for fisheries resources. Wild trout are defined as naturally reproducing trout populations and could include native and introduced brook trout (*Salvelinus fontinalis*), introduced rainbow trout (*Oncorhynchus mykiss*), and introduced brown trout (*Salmo trutta*). The selection of wild trout as the Aquatic MIS is based upon their sensitivity to potential habitat changes associated with land management activities, their broad distribution across the Forest, and their location within headwater streams that are often in relatively close proximity to management activities and set the stage for aquatic habitat conditions downstream. If land management activities affect wild trout populations, then chances are the communities downstream may also be affected.

During the plan revision process, the MIS for aquatic resources has been re-defined from wild trout to native brook trout. It is felt that the native brook trout are a better reflection of the natural processes and community structure of healthy aquatic ecosystems on the Forest, and there is a growing emphasis on the protection and recovery of native brook trout populations throughout their range. Rainbow and brown trout are non-native species, and it is unclear if their ecological relationships with other members of the aquatic community are similar to brook trout.

Habitat characteristics of native brook trout, and non-native browns and rainbows are relatively similar, although brown trout are more tolerant of temperature and sediment, and rainbow trout are more tolerant of higher water velocities. Optimum habitats for native brook trout are streams with clean, cold, well-oxygenated water. They prefer water temperatures around 57-61 F and do poorly when water temperatures exceed 68 F for extended periods (NatureServe 2005). Brook trout are fall spawners and excavate redds in clean gravel beds. Brook trout feed primarily on aquatic and terrestrial insects, but will eat a wide range of organisms. Brook trout also prefer a mix of habitat types (pools, riffles, runs) and hiding cover (Raleigh 1982).

The MNF supports several hundred miles of coldwater streams suitable for wild trout. In 1974, the Forest tabulated a list of streams that occur within the proclamation boundary. Stream miles were calculated separately for coldwater streams with wild trout populations, coldwater streams with stocked trout, streams supporting warm water fisheries, and streams with sterile water quality. In addition, stream miles were classified according to their location on NFS lands or privately owned lands within the proclamation boundary. For the purpose of this analysis, the 1974 stream list provided the basis for the distribution of wild trout populations near the time of the signing of the 1986 Forest Plan.

In 2001, the West Virginia Department of Environmental Protection (WVDEP) published a presumptive list of Tier 2.5 streams in accordance to the anti-degradation policy of the Clean Water Act. Under the anti-degradation rule, Tier 2.5 streams are those streams that support naturally reproducing trout populations, are identified as reference streams, or have a high biological rating that indicates high water quality. Approximately 614 miles were designated as Tier 2.5 on NFS lands, 460 miles for trout, 94 miles as high quality, 41 miles as reference streams, and the rest were a mix of reference and high quality, or unidentified (WVDEP web site). This information, along with other fish population data available to the Forest, was considered during the evaluation of the current distribution of wild trout across the Forest.

A comparison of the information available on the distribution of wild trout populations across the MNF between 1974 to present indicates population trends are largely stable, with noted exceptions attributed to acid deposition. This information suggests that Forest Plan goals, objectives, standards, and guidelines support the protection and enhancement of aquatic habitat conditions and contributes to the maintenance of viable wild trout populations.

However, there is reason to believe that acid deposition is contributing to a shrinking distribution of wild trout populations in stream systems across the Forest. Using GIS data to overlay Tier 2.5 streams on acid sensitive geology, we found that an estimated 135 miles of Tier 2.5 streams on NFS lands are located on geologic types considered highly sensitive to acid deposition. Most streams that may have lost or are in the process of losing wild trout populations occur in watersheds with a geologic composition that characteristically provides poor acid neutralizing capacity. This finding is substantiated by reports of stream acidification in areas across the mid-Atlantic Highlands that include streams of the MNF (US EPA 2000). Conditions that contribute to stream acidification and their effects on wild trout populations are largely beyond the jurisdiction of the Forest Service to influence. However, the West Virginia Division of Natural Resources has developed a program to add limestone fines to poorly buffered stream systems to help neutralize the effects of acid deposition on stream pH. Through this effort, some streams are continuing to support wild fish populations despite their inherent susceptibility to acid deposition.

Although the distribution of wild trout populations appears to be relatively stable across the Forest where water chemistry allows, it is likely that wild trout productivity is impaired throughout this distribution. Wild trout populations have been affected by a wide variety of influences. Some influences are associated with stochastic events, such as periodic floods and droughts, which occur unpredictably in nature. Deterministic factors associated with in-stream habitat conditions are other elements that have impaired wild trout populations. These include but are not limited to water chemistry (*e.g.* pH), habitat composition and quality (*e.g.* pool and riffle development), structural complexity (*e.g.* large woody debris density), channel stability (*e.g.* vertical and lateral stability), sediment composition (*e.g.* percent fine sediment), habitat connectivity (*e.g.* migration barriers), and stream temperatures (*e.g.* shade). Fishing pressure (or more specifically, harvest mortality) can also influence trout populations.

A recent analysis of native brook trout populations discusses how they have diminished throughout their range in the eastern United States (Hudy et al. 2005). Of the subwatersheds (6^{th} level HUC) that were studied in their historic range, native brook trout were extirpated from 21 percent. In the subwatersheds where self-sustaining native brook trout populations are present, habitat is considered “greatly reduced” (i.e., lost over 50 percent of the habitat supporting self-sustaining populations) in 45 percent of the subwatersheds. Consistent with conditions on the MNF, many of the extirpations and reductions are attributed to logging and agricultural activities that occurred around the turn of the last century and contemporary impacts are continuing to cause losses in native brook trout habitat and populations today.

Current management of NFS lands has the greatest potential to influence wild trout populations by directly altering in-stream habitat conditions, by affecting natural watershed processes that indirectly influence in-stream habitat conditions, and by changing access to wild trout streams. A relatively stable distribution of wild trout populations across the Forest suggests habitat requirements are being satisfied where water chemistry allows. However, as acid deposition continues to affect more streams, wild trout populations will likely continue to lose some degree of resiliency to other agents of disturbance. Therefore, it is important that land management on NFS lands strive to protect and restore natural processes and functions that contribute to recovery trends for stream resources if wild trout populations are to remain viable at the Forest level while productivity is to improve at the stream level.

ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Resource protection methods come in the form of laws, regulations, policies, FSM and FSH direction, Forest Plan direction, and Forest Plan implementation procedures. An integral part of protecting watershed and aquatic conditions is the protection of soil resources. See the *Soil Resource* section for more detailed information.

Laws, Regulations, and Policies

The direction found in the Forest Plan is framed by the laws, policies and direction found in other national and regional plans. The primary laws that relate to aquatic resource management include:

- The Organic Administration Act of 1897.
- The Multiple-Use Sustained-Yield Act of 1960
- The National Forest Management Act of 1976 (NFMA)
- The Clean Water Act of 1972
- Forest and Rangeland Renewable Resource Planning Act (RPA) of 1974

The policies developed by the Forest Service that relate to soil and water resources are primarily contained within federal regulations (36 CFR 219.23) that were written to guide implementation of the National Forest Management Act (NFMA). Policies directing the protection of fish habitat (36 CFR 219.19) also influence soil and water activities due to the impacts associated with sedimentation and runoff. Direction on protecting aquatic resources can also be found within Forest Service Manuals and Handbooks.

The National Forests were first established under the Organic Administration Act of 1897, in part "…to improve and protect the forests within the boundaries or for the purposes of securing favorable conditions of water flows…"

The Multiple Use Sustained Yield Act of 1960 says that the national forests are to be used for outdoor recreation, range, timber, watershed, and wildlife and fish purposes. It requires "...harmonious and coordinated management of the various resources...and not necessarily the combination of uses that will give the greatest dollar return of the greatest unit output.

The NFMA directs National Forests to "…insure that timber will be harvested from National Forest System lands only where protection is provided for streams, stream-banks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat (16 U.S.C. 1604 (E))." The Act further emphasizes the need for multiple use and sustained yield of the products and services obtained from the Forest, including coordination to maintain watersheds, wildlife and fish, timber, wilderness, and other considerations.

The objective of the Clean Water Act is "…to restore and maintain the chemical, physical and biological integrity of the nation's waters" (33 USCA 1251(a)). It directs the States to set Water Quality Standards and Best Management Practices with the EPA's guidance. The Act's anti-degradation policy calls for federal agencies to "…protect and maintain water quality which exceeds the levels necessary to support fisheries and recreation."

The Forest and Rangeland Renewable Resources Planning Act (1974) requires an assessment of the present and potential productivity of the land. Regulations specify guidelines for land management plans to achieve the goals of the program that "…insure that timber will be harvested from National Forest System lands only where …soil, slope or other watershed conditions will not be irreversibly damaged."

The Forest Service Manual (FSM) directs the agency to "Manage riparian areas under the principles of multiple-use and sustained-yield, while emphasizing protection and improvement of soil, water, and vegetation, particularly because of their effects upon aquatic and wildlife resources. Give preferential consideration to riparian-dependent resources when conflicts among land use activities occur" (FSM 2526.03).

In addition to providing direction for protecting fish habitat, there is also direction to protect fish populations. NFMA, the 1983 USDA Departmental Regulation 9500-4, FSM 2622 and FSM 2670 all include language for maintaining viable populations of native and desired non-native fish species. Direction for the identification and protection of management indicator species (MIS) are contained in the NFMA implementing regulations (36 CFR 219.19) and FSM 2620.

Because the Forest Service partners with other agencies, additional laws, policies, and direction are used to accomplish partnership goals and objectives. Opportunities are specially important in watersheds where NFS lands are a small percentage of the overall land base.

Forest Plan Direction

The 1986 Forest Plan direction for the management and protection of watershed, riparian, and aquatic resources occurs through Forest-wide general direction and standard/guidelines. Direction is also found within Management Prescriptions and Appendices R and S. During the revision process, Forest-wide direction has been expanded to include additional goals, and a new description of desired conditions. Objectives, standards, and guidelines have also been rewritten in some instances to provide more concise and clearer direction, and better integration between resources. Some 1986 Plan direction has been removed, including items that were process-oriented, or that were repeating existing law or policy.

The principal task of the watershed and aquatics programs that are guided by the Forest Plan is to protect, maintain, and enhance watershed and aquatic conditions. Program activities include conducting inventories, monitoring the effects of management activities, identifying proper mitigation measures, and implementing restoration projects.

In general, standards and guidelines are established to protect water quality and aquatic ecosystems on the Forest. The standards and guidelines are designed to:

- Prevent or reduce sedimentation related to management activities,
- Protect riparian areas and streamside vegetation,
- Protect water quality and quantity,
- Maintain or improve habitat for native brook trout and species of concern, and
- Restore or rehabilitate watershed and aquatic conditions to support their designated uses.

Forest Plan Implementation

The intent of the Forest Plan, as revised, is to provide overall direction for the protection and recovery of watershed and aquatic conditions at a programmatic level. As such, the direction is typically general in nature to allow for flexibility in meeting site-specific conditions. The direction found within the 2006 Forest Plan is implemented through more site-specific planning efforts such as watershed assessments, project-level planning, NEPA analysis, and inventory and monitoring. These smaller-scale evaluations allow for a more complete description of existing and desired conditions, resource objectives, restoration opportunities, and potential effects associated with land management activities than what is possible at the Forest Plan or landscape scale.

Watershed Assessment – Assessments at the watershed scale can be used to identify effects associated with past management, general watershed characteristics, sensitive areas, potential factors limiting the aquatic biota, and opportunities to protect and restore watershed, riparian and aquatic conditions.

Inventory – Inventories are conducted to collect data on aquatic habitat conditions, water quality, fish population data, and watershed conditions. This information is important to establish watershed and aquatic program priorities and direction, as well as for support to other land management activities.

NEPA Analysis – Proposed management activities and mitigation measures are analyzed for potential effects to the watershed, riparian, and aquatic resources by alternative. Effects are disclosed to the public for review and comment. Site-specific design features and mitigation are carried forward into the decision document and applicable contract clauses, permits, or operating plans for the proposed project or activities. Based on field data collected, site-specific mitigation can be designed. This may include the simple application of Forest-wide direction, or it may include additional measures to protect or restore the watershed, riparian, and aquatic resources such as alteration of proposed activities or methods, avoidance of high- risk areas, buffer extensions, road improvements, siltation fences, sediment traps, leaving additional nutrient sources on site, liming, or fertilizing.

Monitoring and Evaluation – Monitoring can occur at the Forest-wide or project level to confirm that specific mitigation is occurring and that it has the desired effects. If monitoring data shows that mitigation measures are not being implemented properly or having the desired results, then adjustments can be designed into future planning efforts.

Effects Common to All Alternatives

There are a variety of management activities and public uses that can affect watershed and aquatic conditions, and the relative amount of these activities may, in some cases, vary by alternative. However, they are likely to be present to some extent in all alternatives. Activities that are implemented can potentially affect watershed and aquatic conditions either positively or negatively. Standards and guidelines are designed to minimize or mitigate the potential negative effects, but even with their application, unavoidable effects may occur as a result of project implementation.

The common mechanisms for activities affecting watershed, riparian and aquatic conditions are generally: 1) vegetation impacts, especially in riparian area, 2) ground disturbance that increases erosion and the potential for sedimentation, and 3) direct and indirect modifications of stream channels or floodplains. The potential for management activities to affect these mechanisms is largely dependent on the scope and location of the action, which is best described at a site-specific level. Nevertheless, at the programmatic scale, there are some common effects that can be anticipated with implementing the Forest Plan.

General Effects from Vegetation Management

Trees influence a variety of watershed and aquatic ecosystem functions, including stream flow, nutrient cycling, organic input, water quality, channel stability and habitat complexity. Trees in riparian areas are especially important for the role they play in protecting and maintaining aquatic ecosystems. Stream shading from riparian areas helps maintain coldwater temperatures important for native brook trout and coldwater communities. Leaves and branches from riparian areas are important sources of food and organic inputs in headwater streams. Riparian forests are the primary source of LWD, which provides channel structure important for channel stability, habitat complexity and the retention of sediment, moisture and organic matter. The root masses of riparian trees also help maintain bank stability.

Land management activities that reduce vegetation and are located within close proximity to stream channels have the potential to affect riparian vegetation and aquatic ecosystems. Timber harvesting, roads, grazing allotments, wildlife openings, power line corridors, dispersed recreation, and developed recreation sites are a few of the activities that can affect riparian areas.

Forest-wide directions within the 1986 and 2006 Forest Plans are intended to maintain or enhance riparian vegetation and the role it plays in aquatic ecosystem health. The plans differ in language, but both allow for adjustments to riparian protection according to site-specific conditions. The 2006 Plan includes a standard for buffer strip widths that restrict programmed timber harvest in order to protect riparian and aquatic conditions. The language in the 1986 Plan is more permissive, but does not preclude buffer strips with no harvest. Recent projects designed under the 1986 Plan typically had buffer strip widths similar to those prescribed in the 2006 Plan to protect stream channels and provide sources of LWD.

Direction for Water and Riparian Resources can be found in the 1986 Plan under FSM 2500, Water and Soil, pages 79-82b. A number of standards and guidelines address stream channel and riparian resource protection in the 2006 Plan. Two good examples are Forest-wide Standards SW34 and SW37 shown below.

<table>
<tr><td>Standard</td><td>SW34</td><td>No programmed harvest shall occur within the channel buffers identified in the table in SW37. Tree removal from the buffers may only take place if needed to meet aquatic or riparian resource management needs, or to;
a) Provide habitat improvements for aquatic or riparian species, or threatened, endangered, sensitive, and locally rare species;
b) Provide for public or worker safety;
c) Construct or renovate an approved facility;
d) Construct temporary road, skid road, or utility corridor crossings;
e) Conduct aquatic or riparian-related research, or
f) Allow for cable yarding.</td></tr>
<tr><td>Standard</td><td>SW37</td><td>During project-level planning and implementation, determine channel buffers for streams that would potentially be affected by proposed activities. The following table represents default buffer widths to be applied to both sides of the channel.
<table><tr><th>Stream Classification</th><th>Buffer Width</th></tr><tr><td>Perennial</td><td>100 feet</td></tr><tr><td>Large Intermittent (>50-acre drainage area)</td><td>100 feet</td></tr><tr><td>Small Intermittent (<50-acre drainage area)</td><td>50 feet</td></tr><tr><td>Ephemeral</td><td>25 feet</td></tr></table>
Buffer widths may be adjusted based on interdisciplinary review and site-specific field investigation. The buffers shall, at a minimum, encompass the riparian area defined on the basis of soils, vegetation and hydrology and the ecological functions and values associated with the riparian area.</td></tr>
</table>

Application of this direction, as well as other related standards and guidelines, should protect streamside vegetation and reduce the potential for direct and indirect effects on stream shading, LWD recruitment, organic inputs, and bank stability, which are important for protecting habitat conditions for native brook trout and aquatic species of concern.

Trees also play a role in the hydrologic function and nutrient cycling within watersheds. Runoff from forested watersheds is influenced by a number of factors such as precipitation patterns, vegetative cover, soil characteristics, elevation, and topography. Management activities that alter soil or vegetative characteristics can potentially affect the hydrologic response of the watershed if the size and intensity of the activity is great enough.

Studies of the effects of timber harvesting on stream flows in small, headwater drainages have shown that, as hardwood forests are harvested, evapotranspiration is reduced and stream flows can increase (Lull and Reinhart 1967, Hornbeck et al. 1997, Kochenderfer et al. 1997). This effect is most pronounced during the growing season and the increase is relatively short lived (Hewlett and Helvey 1970, Douglass and Swank 1972, Swank et al. 2001). Within a year, as the harvested sites revegetate, the influence on stream flows is greatly reduced and the hydrologic response of the site generally returns to pre-harvest conditions in 5-10 years (Hornbeck et al. 1997, Swank et al. 2001).

Increased stream flows due to timber harvesting primarily occur during the summer and fall when flows are typically at their lowest (Hornbeck 1973, Hornbeck et al. 1997, Swank et al. 2001). Studies show that timber harvesting can affect storm flows and peak flows, mainly during the growing season, and to a lesser extent during the dormant season (Hewlett and Helvey

1970, Swank et al. 2001). In watersheds that receive snow during the dormant season, peak flows can even be reduced because of changes in the distribution and melting of snow packs due to timber harvesting (Hornbeck 1973, Hornbeck et al. 1997). In a 74-acre watershed that was clearcut on the Fernow Experimental Forest, peak flows increased an average of 21 percent during the growing season and decreased 4 percent in the dormant season (Reinhart et al. 1963).

The amount of stream flow increase is largely dependent upon the type of harvest (e.g. clearcutting, partial cutting, or thinning) and the size of the area harvested (Reinhart et al. 1963, Douglass and Swank 1972, Arthur et al. 1998, Swank et al. 2001). Approximately 20-30 percent of the watershed basal area needs to be removed before an increase in flows due to harvesting can be detected (Hornbeck et al. 1997, Hornbeck and Kochenderfer 2000). Although increases in storm flows and peak flows have been measured on small, headwater channels where the entire catchment has been harvested, the effect on downstream channels is quickly diminished due to the limited treatment area relative to the increasing drainage size. In order to influence large-scale floods, large-scale harvesting would have to occur throughout a watershed (Hornbeck and Kochenderfer 2000). Researchers have generally concluded that contemporary timber harvesting in forests of the eastern United States is not on a scale that would affect flooding downstream (Douglass and Swank 1972, Hornbeck 1973, Hornbeck et al 1997). Potential effects on smaller, headwater drainage areas are best determined at the project scale.

The role of trees in nutrient cycling is a growing concern in watersheds with geologies that have poor acid-buffering capacity and are sensitive to acid deposition. Soil nutrient loss and base cation depletion due to acid deposition can impact water quality in the streams draining these watersheds (see the *Soil Resource* section for a more detailed description). A number of streams have already experienced a decrease in pH levels and no longer support aquatic life without the help of mitigation measures like the application of limestone sand. The concern is that additional soil disturbance and removal of timber can contribute to the loss of soil nutrients and base cations, and exacerbate the effects of acid deposition. Our understanding of the impacts of acid deposition on watersheds and aquatic ecosystems is increasing, but how land management activities relate to this issue is currently unclear.

Forest-wide direction within the 1986 Forest Plan to address potential soil nutrient loss and base cation depletion due to acid deposition is lacking. The 2006 Forest Plan includes standards and guidelines to address soil productivity and its potential influence on aquatic ecosystems. SW08 and SW13, below, are good examples. The *Soil Resource* section has more information on how Forest Plan strategies were designed to adequately address this issue.

Standard	SW08	Management actions that have the potential to contribute to soil nutrient depletion shall be evaluated for the potential effects of depletion in relation to on-site acid deposition conditions.
Guideline	SW13	Consider liming soils with a surface pH of less than 5.5 on seeding projects, except where there is an objective to maintain acidic ecosystems.

General Effects from Ground Disturbance

The primary concern is the potential to affect watershed and aquatic conditions due to ground-disturbing activities that cause erosion and reduce water quality and fish habitat. The extent of the effect is largely based on the magnitude of the ground disturbance, soil characteristics, topography, proximity to a stream channel, effectiveness of the mitigation measures, and the existing conditions of the receiving channel. Elevated sediment levels can adversely affect spawning and rearing habitat, and macro-invertebrate populations that are important food sources for fish.

Natural watershed conditions on the MNF add to the potential for sedimentation impacts on aquatic ecosystems. Approximately 80 percent of the MNF is classified as having highly erosive soils due, in part, to the steep topography, areas of Mauch Chunk geology, and high amounts of precipitation. These conditions, coupled with past and present activities both on and off-Forest, have resulted in roughly two thirds of the streams on the MNF having fine sediment (less than 4mm in size) at or above levels that begin to impair trout productivity.

There are a number of programs and projects that can result in ground disturbance such as timber harvesting, roads, trails, dispersed and developed recreation sites, mining, watershed improvement projects, fish and wildlife projects, and range allotments. The greatest source of sediment due to forest management activities is generally associated with roads (Duncan et al. 1987, Waters 1995). Closing unneeded roads and improving the drainage on existing roads can help reduce sediment inputs (Swift Jr. 1984, Trieu 1999).

Forest-wide direction within the 1986 and 2006 Forest Plans are intended to minimize soil disturbance, control erosion and provide filter strips to trap sediment. The plans differ in language for developing filter strip widths, but both allow for adjustments based on site specific conditions. Direction for Water and Riparian Resources can be found in the 1986 Plan under FSM 2500, Water and Soil, pages 79-82b, and Appendix R. In the 2006 Plan, a number of standards and guidelines address potential ground disturbance and erosion control. SW40, SW51, and SW62 provide good examples of direction to minimize the area of disturbed soils and avoid ground disturbance within close proximity of stream channels.

Standard	SW40	Skid trails and landings shall not be constructed within 100 feet of perennial, intermittent, and ephemeral channels except at crossings or when location outside the 100-foot zone pose a greater risk to aquatic or riparian resources. The 100-foot filter strip may be modified based on site-specific conditions such as soil type, slope, and stability.
Guideline	SW51	Ground disturbance should be avoided within seeps, vernal pools, bogs, fens, and other wetlands during project implementation. These areas should be managed to protect wet soils and rare plants and provide wildlife watering sources using the following protection: a) No new system roads or skid roads should be located within these areas except at essential crossings. Such crossings should be designed to minimize disturbance to the extent practical. b) Logs should not be skidded through these areas. Keep slash and logs out of them. c) Where available, maintain a canopy of 60-100 percent crown closure within and adjacent to these areas unless a more open canopy is needed for TEP species or RFSS management. d) Mast trees or shrubs may be planted in seeps if mast plants are currently lacking.
Guideline	SW62	Stream crossing construction on temporary and permanent roads should be completed as soon as practical, with mitigation as needed to minimize the potential for sedimentation.

Application of this direction, as well as other related direction, would reduce the potential for sedimentation by retaining filter strips, protecting sensitive areas, and rehabilitating disturbed sites. Filter strips have different management objectives than buffer strips so the widths of filter and buffer strips may vary. In our context, buffer strips primarily refer to riparian forests and standing vegetation, and are designed to provide stream shading, LWD recruitment and bank stability. Filter strips are an area of undisturbed ground between management activities and stream channels so sediment can settle out in the groundcover before reaching the channel network. Sediment movement can also be reduced by quickly revegetating and stabilizing disturbed soils.

General Effects from Modification of Channels and Floodplains

Streams and floodplains are in a dynamic equilibrium with the watersheds that surround them. The natural variability of stream flow, sediment movement, and inputs from riparian vegetation help to shape the aquatic ecosystem characteristics and stability. Alteration of any one of these elements can influence the others and cause a trend toward instability. Modifications to stream flows can occur through road-related impacts or potentially through extensive vegetation removal. Increased flows can result in increased bank erosion or channel down-cutting, which alters the channel morphology and habitat characteristics. Increased sediment deposition, due to ground disturbance or modified runoff patterns, can reduce the carrying capacity of the channel and also result in bank erosion and lateral movement of the channel. Loss of riparian vegetation can reduce bank stability, channel stability, and habitat complexity.

Modifications can also occur through physical features that constrict stream channels or floodplains. Stream crossings, such as culverts, are often narrower than the natural channel width, which can result in higher water velocities and localized erosion. Road beds that encroach upon floodplains can constrict channels, resulting in altered flow conditions and increased stream instability. The channel constrictions created by culverts can also create passage barriers for aquatic organisms.

Language in the 1986 Forest Plan did not speak specifically to channel and floodplain modifications, so standards and guidelines have been added in the 2006 Plan to protect channel and floodplain conditions. SW35, SW36, SW46, and SW60 are good examples.

Standard	SW35	Where new roads and skid roads cross stream channels, channel and bank stability shall be maintained.
Standard	SW36	When stream crossing structures are removed, stream channels shall be restored to their near-natural morphology (width, depth, and gradient associations for streambeds, bands, floodplains, and terraces). Disturbed soil shall be stabilized.
Standard	SW46	New structures (culverts, bridges, etc.) shall be designed to accommodate storm flows expected to occur while the structures are in place. Use scientifically accepted methods for calculating expected storm flows.
Guideline	SW60	Crossings should be designed so stream flow does not pond above the structure during normal flows to reduce sediment deposition and safely pass high flows.

Application of this direction, as well as other related direction, would greatly reduce the potential for stream channel of floodplain modification from management activities.

General Effects from Specific Forest Programs or Activities

There are a variety of resource management programs and activities that can contribute to vegetation impacts, ground disturbance, and modification of channels and floodplains. Many of these programs are relatively minor at the landscape scale, or they would not vary much between alternatives. All can result in localized effects and have the potential to contribute to cumulative effects within a watershed when combined with other land management activities occurring both on and off Forest. Forest-wide direction is designed to minimize and mitigate the potential effects on watershed and aquatic conditions, but some effects are unavoidable and there is an inherent risk when projects are implemented.

Timber Management – Timber management can affect a number of watershed processes and aquatic ecosystem functions by the removal of timber and potential for ground disturbance. The potential effects depend upon the quantity of timber removed, the logging methods employed, and the site-specific conditions.

The removal of timber can potentially affect hydrologic cycles, nutrient cycles, LWD recruitment, stream shading, organic inputs, and channel and bank stability. Timber management is one program that has the potential to alter vegetation on a scale that could potentially modify stream flows in small, headwater areas. The effects are likely to be localized, but could contribute to cumulative impacts downstream if channel erosion occurs. If nutrient and base cation loss occurs from harvesting in watersheds with acid sensitive geologies, the potential loss could contribute cumulatively to the impacts occurring from acid deposition. The potential effects on LWD recruitment, stream shading, organic inputs, and bank stability are addressed through Forest-wide direction for the management of riparian and streamside vegetation.

Timber harvesting also results in areas of ground disturbance, the extent of which depends on the logging method used. The logging method that is the greatest concern for watershed, riparian and aquatic resources is conventional logging using ground-based equipment. The potential for soil disturbance in conventional units is mainly associated with skid roads and landings. In general, the level of soil disturbance is about 10 percent of the harvest area (Kochenderfer et al. 1997). The level of soil disturbance in helicopter units is lower and primarily associated with landings, including servicing and re-fueling sites.

Forest-wide direction for filter strips, water and erosion control structures, and revegetation of disturbed soils are intended to minimize the area of disturbance and reduce the potential movement of sediment into channel networks. Revegetation of exposed soils can be fairly rapid following logging activities, but sediment that enters a channel network when soils are disturbed can remain in the system for years, even decades (NCASI 1999).

Landings are used in both conventional and helicopter harvest systems. Helicopter landings are generally around 2 acres in size and landings in conventional logging units are approximately ½ acre in size. The erosion potential of landing sites will be reduced if they are treated by seeding, mulching, and fertilizing. However, soil compaction can be a problem with lasting long-term effects and ripping may be necessary. Landings are often revegetated and used as wildlife openings.

Alternatives developed during the revision process incorporate different timber management strategies that can be used to analyze potential impacts between alternatives. The area that can be potentially harvested, the potential acres treated, the logging methods used, and the potential volume harvested can be used to compare alternatives and the potential effects to watershed, riparian, and aquatic resources.

Roads and Trails – Roads, and to a lesser extent trails, can contribute to the general effects described above by removing vegetation, increasing erosion and sedimentation, and modifying stream channels and floodplains. The extent of effects depends on the topography, location, level of use, level of maintenance, soils, geology, hydrology, and the nature of surrounding vegetation. Of particular concern are roads that cross, or are in close proximity to, stream channels. An estimated 216 miles of roads on NFS lands are within 100 feet of stream channels identified on 1:24,000 scale maps. The mileage is higher when unmapped channels, including ephemeral channels, are considered. Roads within 100 feet of channels are often hydrologically connected to the channel, and the trees removed to construct them reduce riparian vegetation and the recruitment potential of LWD.

Roads can modify the hydrologic response of an area by intercepting and converting ground water to surface flows, by increasing the drainage density of a watershed where ditch lines flow into functioning channels, and by reducing water infiltration rates through compaction of road surfaces. The level of modification depends on a number of variables such as soil type, slope and location of the road, frequency of road drainage structures, road surface material, and density of roads in a watershed.

Road construction creates ground disturbance that can deliver sediment to stream channels. Cut slopes, fill slopes, road surfaces, and drainage outfalls expose soils, modify runoff patterns and create new sources of surface erosion. Factors influencing road-related surface erosion include soil type, slope position, drainage frequency, road surface material, level of use, and the age of the road. The potential for erosion and sedimentation increases as the road slope increases. This occurs because water moves at higher velocities and increased volumes as slope increases. Drainage structure, function, and spacing are important in minimizing the amount of surface flow, which directly affects surface erosion. Road reconstruction and maintenance can result in sediment effects in the short term, but can correct a number of road related problems in the long term by increasing cross drainages, replacing problem culverts, maintaining culverts, and providing road surfacing such as gravel to reduce erosion potential.

Road crossings can influence stream channels by delivering sediment and other pollutants to the drainage network, by constricting channel widths and floodplain functions, by modifying the movement of water, wood, organic and inorganic sediments, and by modifying the movement and passage of aquatic organisms. Variables that effect the level of influence road crossings have on stream channels and their biota include the type of crossing, width of the crossing relative to channel width, stability of the channel above and below the crossing, level of road use, and frequency of drainage structures on the road.

The influence of culverts on the movement of aquatic organisms is becoming an increasingly important issue related to the connectivity of stream segments and populations. The improper sizing and installation of culverts can result in passage barriers for organisms moving upstream and down. This in turn has the potential to isolate populations and habitat upstream of barrier culverts, and reduce the genetic mixing between populations. Should an upstream population fail, for example, during a period of drought, then downstream populations would be unable re-colonize the habitat during more favorable conditions. In some cases, though, the presence of a barrier can be favorable if it protects populations that are at risk from non-native species moving upstream.

Problems typically arise from culverts that are undersized and create water velocities that are impassable, culverts set too high so fish and other organisms are unable to enter from downstream, or culverts that are difficult to pass through because of their length, flow conditions and/or substrate. The Forest has not completed an inventory of road crossings, so the number of existing passage problems is undetermined. Direction in the 2006 Plan (WF21) would provide passage when new roads are constructed or reconstructed; unless a passage barrier is needed to meet aquatic resource management objectives (e.g., restrict the movement of non-native or undesirable species). There is also direction (SW32) to assess existing or proposed road stream crossings during watershed or project analyses for passage of aquatic organisms, and to prioritize crossings to address concerns.

Road and trail decommissioning includes a variety of management actions ranging from simple closures to complete obliteration. Obliteration can often ameliorate the long-term effects of a road or trail as the soil stabilizes, hydrologic function returns, compaction decreases, vegetation matures in former road or trail locations and aquatic passage is restored. Short-term or temporary effects often occur as the decommissioning work is implemented.

Roads are often associated with timber management activities and an assumption in this analysis is that alternatives with more potential harvesting activity would have more roads and road use than alternatives with less activity. It is also assumed that alternatives that have a greater level of conventional harvest would require more roads to access remote units than helicopter logging.

Mineral and Energy Exploration, Development, and Reclamation – Past and present activities associated with mineral and energy development have affected a number of watersheds and streams across the Forest. These developments include old strip mines, deep mines, settling ponds, well sites, pipeline corridors, and access roads. The effects on watershed and aquatic resources vary depending largely on the scale and location of development and mineral ownership. These effects include acid mine discharge, modified drainage patterns, reduced riparian vegetation, and increased erosion and sedimentation.

The level of mineral exploration and development is largely driven by market forces and regulated by existing mining law, so there should be little difference between alternatives and the potential effects to watershed, riparian and aquatic resources. The uncertainty of future development does not allow for a meaningful predictive analysis between alternatives. See the Mineral Resources section in this chapter for more detailed information.

Facilities and Structures – These include a broad array of physical developments and structures, such as administrative facilities, utility developments, communications sites, dams and diversions authorized under special use authorizations, and mining facilities. Usually, there are both short-term and long-term effects from structures, site clearing, and soil disturbance. These effects vary depending on the scale and nature of the development, as well as the setting. Road construction for installation and/or maintenance purposes can contribute to the impacts from the facility. In general, once an area is committed to a facility or structure, there is a permanent commitment of resources. On a Forest-wide scale, facilities and structures comprise an extremely small amount of the land base, and are therefore not expected to have substantial direct, indirect, or cumulative effects on watershed, riparian, or aquatic resources.

Recreation – Developed and dispersed recreation activities can affect watershed and aquatic conditions in a variety of ways. Trails and campsites are often located in close proximity to stream channels and riparian areas, and the concentrated use can result in a loss of vegetation and increased soil disturbance. There are no foreseeable future plans to develop any large-scale recreation facilities or make any changes in the types of recreation allowed on the Forest. Therefore, there are no measurable differences in recreation-related activities that can be analyzed by alternative.

Range Management - Livestock grazing and range improvements may result in impacts to riparian vegetation and ground disturbance in areas where grazing is concentrated. Effects to the soil resource from grazing depend largely on the intensity and timing of forage utilization. Normally, allotment management plans require permittees to move their livestock so that they do not concentrate in sensitive areas, like meadows and riparian areas. Although there could be effects from seasonal trampling and heavy utilization of the soil, the potential for change to the soil resource is relatively slight, especially as livestock grazing only occurs on less than 1 percent of the entire Forest and the animal units per acre are strictly regulated. Mitigation may include developing feeding pads, water cisterns for drinking with an associated hardened pad, and fencing of riparian areas and sensitive wet soils with associated meadow habitat. All of these mitigations act to lessen soil compaction, soil disturbance, erosion and sediment production, and changes in riparian conditions. There is currently no expectation to change the size or amounts of the range allotments under the 1986 or 2006 Forest Plan direction under any alternative. Therefore, there are no measurable differences to watershed, riparian and aquatic resources that can be compared by alternative.

Watershed Improvements – There is a broad range of opportunities to restore watershed conditions across the Forest, such as protecting and restoring riparian areas, road obliteration projects, bank stabilization projects, and other efforts to revegetate and stabilize exposed soils. In the course of implementing these projects ground disturbance and to a lesser extent vegetation impacts will occur. The intent is to minimize the short-term effects to correct long-term problems. Generally, most improvements are relatively small and localized, and have a minor effect on soil loss, sedimentation, and vegetation. These structures have the beneficial effect of reducing erosion and sedimentation over the long term. Additional mitigation such as seeding and mulching can ameliorate the short-term effects from sediment until soils are stabilized.

Opportunities for watershed restoration are typically identified during watershed assessments, project planning and inventory and monitoring activities. These efforts are not likely to change between alternatives, although watershed restoration opportunities within Management Prescription 5.1 may be limited if these recommended Wilderness areas are eventually designated as Wilderness by Congress.

Fish and Wildlife Habitat Improvements – Fish and wildlife habitat improvement projects include activities such as the creation and maintenance of wildlife openings and their access roads, development of watering holes, savannahs, and instream habitat structures, and delivery of limestone sand. Implementation of these projects can result in vegetation impacts and ground disturbance in varying degrees depending on the scope of the project and site conditions. At a landscape scale, habitat improvement projects treat a minor part of the analysis area and the potential benefits and impacts are best analyzed at a localized scale. The habitat improvement programs are unlikely to change much by alternative, although opportunities within MP 5.1 might be limited if these recommended Wilderness areas are eventually designated as Wilderness by Congress.

Wildfire Suppression – Fire suppression activities can produce both direct and indirect effects to watershed, riparian, and aquatic conditions. Some firefighting activities, such as mechanical fire line and safety zone construction, can result in direct long-term effects from vegetation clearing and soil disturbance. In the case of fire line construction, effects are usually magnified by the linear nature of the pattern of disturbance and the crossing of stream channels. This linear nature of the soil disturbance can result in routing sediment directly into a stream. This effect can be mitigated by hand constructing waterbars and small dips to disperse flow onto side slopes. These areas can also be rehabilitated after suppression with mulching and seeding to stabilize disturbed soils.

There have been less than 10 wildfires a year on the MNF in the past 20 years, the majority of which were human-caused. Alternatives that have the potential to increase or reduce road access could affect the susceptibility of areas to human-caused fires, but the frequency of wildfires and their impact on the landscape are unlikely to change by alternative.

Prescribed Fire – Prescribed fire is generally used to reduce ladder fuels and restore or maintain desired vegetative conditions. In these circumstances, fire intensity, severity, and scale are generally lower and smaller than wildfire events. Control and containment features such as fire lines can result in ground disturbance, but the level of prescribed fire activity is relatively minor and the potential effects are negligible. This activity may vary by alternative; but due to the nature of prescribed fire on this Forest (see *Vegetation Management* section), it does not produce large-scale watershed, riparian, or aquatic disturbances. If prescribed burn plans are followed and low-intensity burns typically occur as planned, then the effects would be minimal and temporary.

Special Uses – Special use authorizations vary greatly, from operating concessions to erecting and maintaining large facilities like transmission lines. Some of these activities have the potential for vegetative impacts and soil disturbance. Transmission lines that cross stream channels or special use fields within floodplains can have direct effects on riparian vegetation. The general activities associated with special uses that would affect soils—such as facility and road construction, timber removal, or recreation events—are addressed above. Individual authorizations are for localized areas, and the number, type, and location are unpredictable. Proposals would be analyzed on a case-by-case basis at the project level and would not likely vary by alternative for this analysis.

Direct and Indirect Effects by Alternative

General direct and indirect effects associated with timber management and roads were discussed in the previous section, and the mechanisms for the effects remain the same through all alternatives. What changes between alternatives is the location where timber management could potentially occur, the magnitude of the program, both in acres treated and volume harvested, and the types of harvest methods used, helicopter or conventional.

Suitable Acres by Watershed

The location of the potential harvest activity is defined as the suitable lands within management prescriptions that allow harvest activities. Management prescriptions are areas of land that have a common management emphasis and are described in greater detail in Chapter 2. Management prescriptions that permit a greater level of management activity, such as roads and timber harvesting, are considered to have a greater potential to disturb watershed, riparian and aquatic conditions than those that limit management actions and emphasize wilderness or remote backcountry. The management prescriptions that allow timber management activities in Alternative 1 are MP 2.0, 3.0, 4.0 and 6.1. In Alternatives 2, 2M, 3 and 4, timber management is allowed in MP 3.0, 4.1 and 6.1.

Not all of the acres located within the management prescriptions are available for timber harvest. A number of acres have been removed from the suited timber base due to suitability issues, or to protect other resources such as riparian areas or threatened or endangered species. The remaining acres within the management prescriptions are considered to be the suitable area for timber management.

Using GIS, the suitable lands for each alternative were clipped to fifth-level watersheds to identify what watersheds are potentially affected and to calculate the acres of suitable lands within each watershed. The assumption is the more of a watershed that is available for harvesting; the greater the potential there is for watershed, riparian and aquatic effects to occur. Of particular concern are watersheds that have Mauch Chunk geology or acid sensitive geology. The potential effects to watershed and aquatic conditions are also indicators for potential effects to the aquatic management indicator species (native brook trout) and species of concern that inhabit those watersheds. Table WA-3 displays the acres considered suitable for timber management within each fifth-level watershed by alternative.

Table WA-3. Suitable Timber Management Acres by Watershed by Alternative

Watershed	HUC	Total Acres	Acres Within Forest Boundry	Acres of NFS Land	Acres Suitable For Timber Mgt.				
					Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
South Branch	02070001010	184,100	27,300	9,500	3,855	821	821	821	821
North Fork	02070001020	202,800	136,600	72,300	25,531	22,335	21,966	20,621	22,335
South Branch 1	02070001030	33,500	29,900	17,900	5,564	0	0	0	0
Lunice Creek	02070001040	57,000	800	800	501	660	660	660	660
Mill Creek	02070001050	66,800	7,800	1,500	933	0	0	0	0
U. Tygart Valley	05020001010	96,700	60,800	16,600	9,326	3,741	3,741	3,741	3,741
Tygart Valley Direct Drains	05020001020	78,600	29,800	11,000	6,331	3,589	3,589	3,589	3,589
Leading Creek	05020001030	38,600	1,300	1,000	648	852	852	852	852
Shavers Fork	05020004010	137,200	137,200	97,200	21,577	4,183	4,183	4,105	4,278
Red Creek	05020004020	39,200	38,000	26,600	623	57	30	0	5
Gandy Creek	05020004030	61,100	61,100	18,200	2,315	1,575	1,575	1,333	1,575
Laurel Fork	05020004040	38,600	38,600	22,500	2,912	3,889	3,747	3,747	3,889
Glady Fork	05020004050	40,600	40,600	27,400	13,356	11,646	11,646	11,646	11,646
Blackwater River	05020004060	89,300	45,400	14,200	1,593	1,045	1,045	715	1,100
Dry Fork	05020004070	51,100	51,100	36,700	3,664	0	0	0	0
Horseshoe Run	05020004080	35,300	35,300	13,900	7,236	9,521	9,521	9,521	9,521
Cheat River Direct Drains	05020004090	106,800	51,400	20,200	12,640	16,616	16,616	16,616	16,616
Upper Greenbrier	05050003010	85,100	85,100	69,300	31,837	37,114	37,114	36,890	40,271
Deer Creek	05050003020	74,400	74,400	30,500	17,404	23,331	23,331	22,662	23,331
Greenbrier River 1	05050003040	100,200	87,600	28,000	9,260	16,196	16,196	6,415	16,196
Knapp Creek	05050003060	86,100	78,400	44,500	28,129	33,840	33,840	11,879	35,018
Spring Creek	05050003080	119,000	23,100	7,200	2,392	0	0	0	0
Greenbrier River	05050003090	109,300	72,400	35,500	17,308	19,846	19,846	16,488	23,647
Anthony Creek	05050003100	95,000	94,900	72,400	30,477	42,460	42,460	14,968	49,092
Howards Creek	05050003110	58,400	8,300	7,300	92	120	120	120	352
U. Gauley River	05050005010	44,600	44,100	5,900	3,253	3,832	3,832	3,832	3,832
Williams River	05050005020	82,600	82,600	73,200	18,120	17,239	17,239	17,239	17,559
Gauley River	05050005040	41,700	20,900	12,000	7,966	10,498	10,498	10,498	10,498
Cranberry River	05050005050	62,100	62,100	60,400	16,681	17,842	17,842	9,916	17,842
Cherry River	05050005060	106,000	103,600	28,400	11,996	15,244	15,244	12,329	15,244
Upper Elk River	05050007010	154,200	70,500	33,000	16,950	9,924	9,553	9,885	10,950

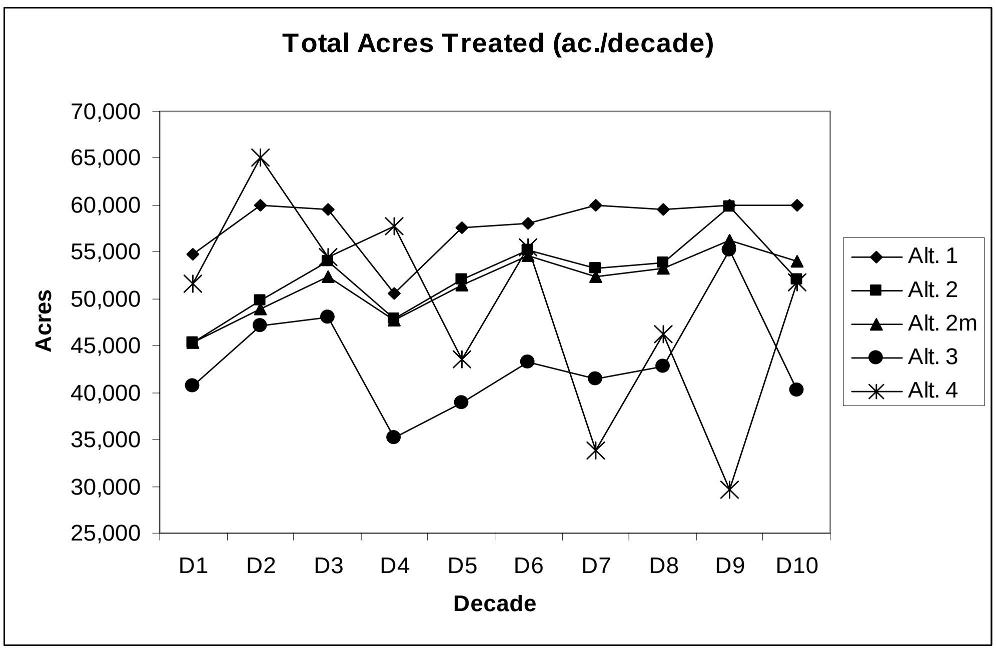
Overall, Alternative 3 has the fewest acres of suitable timber management acres and would potentially affect the fewest number of watersheds (26) of all the alternatives. Alternatives 2, 2M and 4 potentially affect the same number of watersheds (27), but they differ by the total number of suitable acres: Alternative 2 (330,300 ac.), Alternative 2M (329,400 ac.) and Alternative 4 (346,700 ac.). Alternative 1 has the potential to affect all 31 of the fifth-level watersheds in the analysis and has 332,200 acres of suitable area.

Differences between alternatives also occur as the amount of suitable acres within watersheds changes between alternatives. It is assumed that the alternative that has the lowest level of suitable acres within a given watershed has the least potential impact on the watershed. Alternative 3 has the lowest, or tied for lowest, potential impact in 19 of the 31 watersheds. Alternative 1 is next with 11 watersheds, and Alternative 2M, Alternative 2 and Alternative 4 follow in order, as they have the lowest level in 10, 9 and 8 watersheds respectively. The location of potential impacts is one issue that differentiates between alternatives; another is the potential impacts associated with the level of projected harvest activity.

Potential Harvest Activity (acres)

A major objective of vegetation management on the Forest is to create a better distribution of forest age classes and timber harvesting is the primary tool to achieve the objective. Various timber management strategies were run through the Spectrum model based on the allocation of management prescriptions by alternative. Spectrum was run over a 100-150-year period to model the effects of the different strategies. One output of the model is an estimate of the total acres to be harvested per decade. Figure WA-2 displays the long term trends in potential harvest activities by alternative. These numbers are used for the relative comparison of alternatives, but are not intended to represent actual acres of implemented activities.

Figure WA-2. Total Acres Potentially Treated by Alternative per Decade
(From Spectrum modeling)



Assuming a 10-year forest planning cycle during the projected life of the plan, Alternative 3 has the lowest estimated harvest activity in the first decade (40,764 ac.), followed by Alternatives 2 (45,297 ac.), 2M (45,338 ac.), 4 (51,573 ac.), and 1 (54,821 ac.). In subsequent decades, the potential level of activity shifts between alternatives. Alternative 3 maintains the lowest or second lowest level of potential treatment through all decades, while Alternative 1 remains the highest or second highest level through all decades. Alternative 4 has the broadest range with the high level of 65,000 acres in Decade 2 and the low level of 29,600 acres in Decade 9.

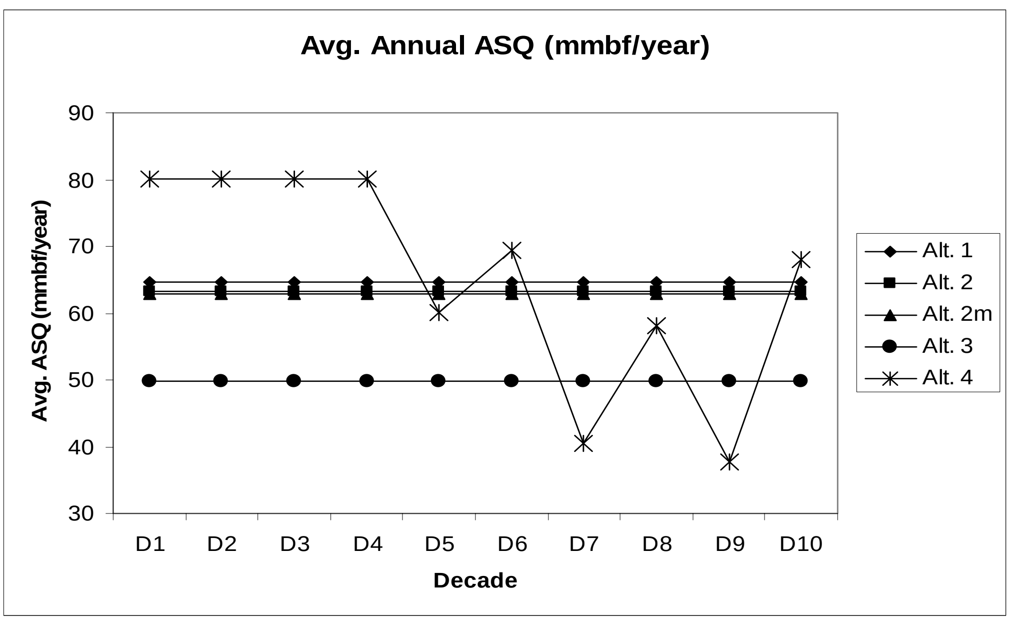
The estimates generated by Spectrum should be considered the maximum potential harvest activity that could occur. The average annual harvest activity in Decade 1 ranges from approximately 4,100 to 5,200 acres per year. In contrast, from 1986 to the present, an average of 3,400 acres has been harvested annually.

The potential effects on watershed and aquatic conditions will depend on how the harvest activity is distributed in the suitable areas, the volume of timber harvested, and the logging methods used. Generally speaking, alternatives that affect fewer acres have a lower risk of impacting watershed, riparian and aquatic conditions. An assumption in this analysis is that alternatives with more harvest activity would have more roads and road use than alternatives with less activity. However, harvest activity could also result in more road reconstruction that could correct or reduce existing impacts to watershed and aquatic resources.

Potential Harvest Activity (Volume)

Another output Spectrum generates is the allowable sale quantity (ASQ) which is a measure of the potential volume of timber harvested and reported as million board feet per year (mmbf/year). The removal of timber can remove nutrients and base cations in acid sensitive areas and potentially contribute to impacts on water chemistry and stream productivity associated with acid deposition. Timber harvest can also potentially increase run-off in small, headwater areas and affect channel stability. The assumption is that in alternatives where more timber is harvested there is a higher potential risk for watershed and aquatic resources to be negatively affected by harvest activities. Figure WA-3 displays the average annual ASQ for each decade.

Figure WA-3. Average Annual Allowable Sale Quantity (ASQ) by Alternative by Decade
(From Spectrum modeling)



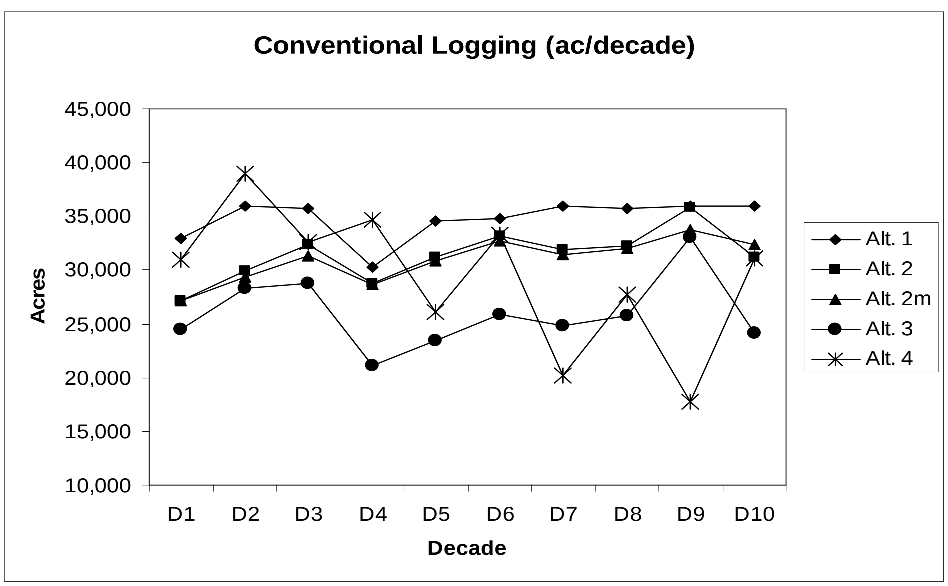
Similar to the other issues, Alternative 3 has the lowest ASQ in the first decade and most of the subsequent decades. The ASQ for Alternative 3 remains at 50 mmbf through all decades. For the life of the plan, Alternative 4 has the highest ASQ at 80 mmbf and it remains at that level for the first four decades before dropping off. For the remaining decades it is highly variable, but does represent the lowest level ASQ at 38 mmbf in Decade 9. Alternatives 2, 2M, and 1 remain constant through the decades at 63, 63, and 65 mmbf, respectively. Although volumes for Alternatives 2 and 2M round to the same number, Alternative 2 is actually about 300,000 mmbf/year higher.

The potential effects of the timber harvest are largely dependent on site-specific conditions that will be determined at the project level. The preference for maximum protection of watershed and aquatic conditions is to minimize the potential risk of harvesting in sensitive areas.

Logging Methods

The most common forms of ground disturbance associated with forest management activities are roads, and timber harvesting using conventional, ground-based equipment. Spectrum modeling assumed that 60 percent of the total acres to be treated would be conventionally logged and 40 percent helicopter logged. This assumption was based on a combination of recent logging history and estimated resource concerns and conditions. The potential effects of conventional and helicopter logging are discussed in greater detail in the previous section and in the *Soil Resources* section. For the purposes of comparing alternatives, only the potential effects of conventional logging will be considered. The percentage of conventional and helicopter logging do not vary between alternatives, so the long-term trends are similar to each other and to the total acres treated. Figure WA-4 displays the projected acres of conventional logging by alternative.

Figure WA-4. Potential Acres Conventionally Logged by Alternative by Decade
(From Spectrum modeling)



Alternative 3 has the lowest level of conventional logging during the life of the plan, followed by Alternative 2, 2M, 4, and 1. The long-term trends are similar to those discussed for total acres treated. The preference for protection of watershed resources is to have less potential ground disturbance to reduce the risk of erosion and sedimentation. Alternatives that have higher levels of conventional logging are also the ones that can potentially affect more watersheds. This is a concern given the highly erosive soils on the Forest, the presence of Mauch Chunk geology in many watersheds, and the potential for soil nutrient loss in areas sensitive to acid deposition.

Spectrum also modeled the proximity of potential harvest activities to the existing road system. Table WA-4 displays the projected level of conventional harvest for each alternative in Decade 1, and the proximity to existing roads. The assumption is that harvest acres that are located away from existing roads may require additional roads to access the units and result in additional ground disturbance and road-related problems.

Table WA-4. Conventional Timber Harvest Acres by Alternative in Decade 1
(Figures represent total acres for the 10-year period)

Activity	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Conventional Harvest Acres	32,893	27,178	27,203	24,458	30,944
Distance to Road: 0/0 to 3/8 mi.	24,219	25,649	25,142	22,848	25,886
Distance to Road: 3/8 to 6/8 mi.	6,529	1,425	2,061	1,057	4,270
Distance to Road: 6/8 to 9/8 mi.	1,045	80	0	553	500
Distance to Road: 9/8 mi. +	1,100	24	0	0	288
Total Distance Greater than 3/8 mile	8,674	1,529	2,061	1,610	5058

More specifically, the assumption is that acres within 3/8 mile of an existing road could be conventionally harvested without the need for additional roads. If the distance is over 3/8 mile, then additional roads would need to be constructed or reconstructed to access the units. See the *Road Transportation System* section for additional information. Alternative 2 has the fewest overall acres that would need road access, followed by Alternatives 3, 2M, 4, and 1. The preference for maximum protection of watershed and aquatic conditions is to minimize the road density and potential road-related impacts.

Comparison of Alternatives – The alternatives were ranked by their potential for direct and indirect effects and the scope of potential activities. Alternatives that were considered to pose the least risk were ranked 1, and alternatives that posed the greatest risk were ranked 5. Table WA-5 displays the rankings by indicator.

From a watershed, riparian and aquatic resources perspective, Alternative 3 poses the least amount of risk for potential effects in five out of the six indicators, followed by Alternatives 2, 2M, 4, and 1. Alternatives 2 and 2M are virtually the same, especially considering that the main difference is the road access to harvest units in Decade 1, and Alternative 2 requires more road access than 2M by Decade 5 (see *Road Transportation System* section).

Table WA-5. Ranking of Alternatives by their Potential Effects and Treatment Area

Issue	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Suitable Acres in Management Areas	4	3	2	1	5
Number of Watersheds Potentially Affected	3	2	2	1	2
Potential Harvest Area (Decade 1)	5	2	3	1	4
Potential Harvest Volume (Decade 1)	3	3	2	1	4
Potential Conventional Logging (Decade 1)	5	2	3	1	4
Road Access to Conventional Units (Decade 1)	5	1	3	2	4
Totals	25	13	15	7	23

Management Indicator Species

Alternatives that result in the lowest level of potential disturbance to watershed, riparian, and aquatic conditions also pose the lowest risk to native brook trout populations. Forest Plan and Revision direction is to maintain or improve habitat conditions for MIS. Native brook trout populations on the MNF are well distributed and considered stable, except in streams draining areas with acid sensitive geology and are susceptible to acid deposition. Direction within the 1986 Forest Plan has allowed for the protection of aquatic habitat conditions and contributed to the viability of trout populations on the Forest. Direction within the revised 2006 Plan is also expected to protect habitat conditions and native brook trout viability.

Although native brook trout populations remain well distributed and stable on the Forest, the productivity of these populations is likely impaired by a number of factors. Effects to aquatic ecosystems are often subtle, difficult to measure, and hard to relate back to any one activity or event. An action may not result in a noticeable effect on habitat conditions or populations, but may create or contribute to the overall stress on the system. These stressors may reduce the productivity of the system, its resiliency to other disturbance events, and affect its ability to recover between disturbance events. Forest management activities can contribute to the impairment even when the potential effects are minimized. The preference for maximum protection of the aquatic resources is to reduce the potential risk to populations by reducing the potential level of activity and the number of watersheds that are affected. Alternative 3 generally has the lowest level of harvest-related management activity of all the alternatives, followed by Alternative 2 and 2M, 4, and then 1.

As noted in the Current Conditions section, Tier 2.5 streams are those that support naturally reproducing trout populations, are identified as reference streams, or have a high biological rating that indicates high water quality. Using Tier 2.5 streams as a representative of native trout streams on the Forest, Table WA-6 displays the number of Tier 2.5 stream miles that are located within active management prescriptions (3.0, 4.1, 6.0) by alternative.

Table WA-6. Miles of Tier 2.5 Streams Within Active Management Prescriptions

Indicator	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Miles within Active Management Prescriptions	380	460	451	353	507
Percent of Tier 2.5 on NFS lands in active MPs	65%	78%	77%	60%	86%

From an aquatic MIS perspective, Alternative 3 poses the least amount of risk for potential effects to native trout streams. Alternative 1 is second, followed by Alternatives 2M, 2 and then 4. The results shown in Table WA-6, however, are oversimplified because the active MPs are not equal in their potential to affect trout streams, and they vary widely in their application by alternative. Most of MP 4.1, for example, has West Virginia northern flying squirrel habitat, where very little management activity would occur. Therefore, MP 4.1 may actually have an overall beneficial effect on trout streams, and this high-elevation prescription area has a large percentage of coldwater streams. Alternative 1 has no MP 4.1, and Alternative 3 has far fewer 4.1 acres compared to Alternatives 4, 2M, and 2. Also, management direction within the 2006 Plan would have a somewhat neutralizing effect on the potential for any of the alternatives to degrade trout streams. The Plan has direction that is designed to avoid or minimize the potential effects of management activities on native brook trout habitat and populations. In active MPs, opportunities would also exist to enhance existing conditions through watershed and fish habitat improvement projects.

Cumulative Effects

The area considered for cumulative effects includes the fifth-level watersheds within the Forest proclamation boundary, and the analysis includes the potential effects of Forest, state and private activities on the waters within and leaving the Forest. Cumulative effects address the environmental consequences from activities implemented or projected within the watersheds in the past, present and reasonably foreseeable future. The combination of activities on NFS, state and private lands can create an effect at a watershed scale that otherwise would not be perceived as a problem at the project or subwatershed scale. In addition to their natural variability, watersheds differ by their management history, ownership patterns, and the types and levels of contemporary management activity. The combination of natural variables, ownership patterns and management activities contribute to the cumulative effects that shape the current conditions of the aquatic ecosystems within the analysis area. Given the variability in watershed conditions, both natural and management related, the discussion of cumulative effects will be general in nature.

The current watershed and aquatic resource conditions in the analysis area are a reflection of the cumulative effects of past and present actions. Streams are deficient in LWD largely due to historic logging activities, sediment levels are elevated due to past and present management activities, and the hydrology of the watersheds is altered due to past and present land uses. Future activities can contribute to these effects or alleviate some of the problems. On NFS lands, the reasonably foreseeable future actions are considered to be the continuation of existing programs such as timber management, roads, developed and dispersed recreation, gas and mineral development, grazing allotments, special uses, fish and wildlife management, and other activities. On a broad scale, the effects of future management on NFS lands may result in some localized effects, but overall should not contribute to any measurable downstream impacts. This is due in part to Forest Plan direction for the protection of soil, water, and riparian resources, the continued natural recovery of watershed conditions across the Forest, and the implementation of watershed, riparian, and aquatic restoration projects. The level of potential harvest, and its distribution across watersheds, should not result in any hydrologic effects at the fifth-level watershed scale. With the exception of areas where roads, trails, or other facilities cross channels, riparian standards and guidelines should maintain the current level of stream shading and LWD recruitment. Opportunities also exist to revegetate and restore areas of degraded riparian conditions.

One concern is that future ground-disturbing activities have the potential to contribute to existing sediment sources, primarily associated with the Forest-wide transportation system. Roads continue to be a chronic source of sediment and additional inputs may be detrimental to the health of aquatic ecosystems depending on the existing site-specific conditions. The recovery of disturbed soils can be relatively quick, which reduces the erosion potential following the disturbance. But sediment that enters a channel can remain in the system for years, even decades, depending on the level of inputs and channel characteristics. Potential new sources could be off-set, in part or wholly, by correcting existing problems and reducing current inputs.

The potential cumulative effects of soil nutrient loss, base cation depletion and acid deposition are discussed in greater detail in the *Soil Resource* section.

The influence of NFS land on cumulative effects for waters draining the analysis area largely depends on the level of ownership. NFS lands average 54 percent of the fifth-level watersheds within the proclamation boundary, ranging from 13 percent in the Upper Gauley River to 100 percent in Lunice Creek. NFS lands are typically located in the higher elevations and headwaters, and the influence of state and private lands increases going downstream. In watersheds where NFS lands are limited, the influence of state and private activities is greater.

Assuming the activities on state and private lands remain relatively constant, existing watershed and stream conditions within those areas should persist in the foreseeable future. Watershed, riparian, and aquatic conditions are modified by roads, rural and agricultural developments, logging, mining, housing developments, and other activities. Direct impacts to aquatic habitats occur through road crossings and flood control efforts. Reduced riparian vegetation effects stream shading, bank stability, LWD recruitment, and channel stability. A wide range of ground-disturbing activities result in soil erosion and sedimentation in streams.

Implementation of Forest-wide standards and guidelines would minimize the potential effects of land management activities on NFS lands and the Forest's potential contribution to cumulative effects. The existing transportation system continues to affect aquatic resources and water quality, and foreseeable actions that improve road-related problems can reduce the potential effects and the contribution to cumulative effects. Foreseeable harvest activities have the potential to contribute to sedimentation and cumulative effects associated with conventional logging and road-related impacts. Future harvest activities also provide an opportunity to correct or reduce existing road-related problems and sediment source. Alternative 3 has the lowest potential for ground-disturbing activities associated with timber management activities, followed by Alternatives 2, 2M, 4, and 1.

Aquatic Species Viability

Similar to protecting the habitat and populations of MIS, the Forest is charged with protecting species viability for native and desired non-native species on NFS lands. Direction within the 1986 and 2006 Forest Plans is intended to protect the elements that support healthy aquatic ecosystems, including the aquatic biota. However, cumulative impacts from past and present activities, both on and off-Forest, continue to affect populations. The stream conditions on the Forest today are impaired for a number of reasons. Loss of channel structure, loss of riparian vegetation, effects to stream temperatures, elevated sediment levels, and acid deposition stress the resistance and resiliency of the stream ecosystems. Many of the mechanisms that created those stresses are still in place, so the issue of minimizing potential impacts associated with future actions becomes a greater concern for systems that are already stressed than if the aquatic ecosystems were healthy and functioning properly. The disturbance history within the watersheds is probably a greater influence on the existing population distribution and dynamics than the potential effects associated with future management actions. However, future management actions can contribute, either positively or negatively, to the factors that are limiting populations in the analysis area.

Viability outcomes were determined for each of the aquatic species of concern including 30 fish species, two crayfish, two mollusks, and one amphibian. Because of the variability within watershed conditions, including ownership patterns and the potential for cumulative effects, the viability outcomes were made for each species in each watershed in which they are reported to inhabit (see Appendix E). Table WA-7 summarizes the viability outcomes by alternative.

Table WA-7. Viability Outcomes by Alternative

Outcome	Number of Species With the Specified Outcome				
	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
A	1	1	1	1	1
B	11	11	11	11	11
C	4	4	4	4	4
D	11	22	22	25	22
E	65	60	60	57	60
F	58	52	52	52	52

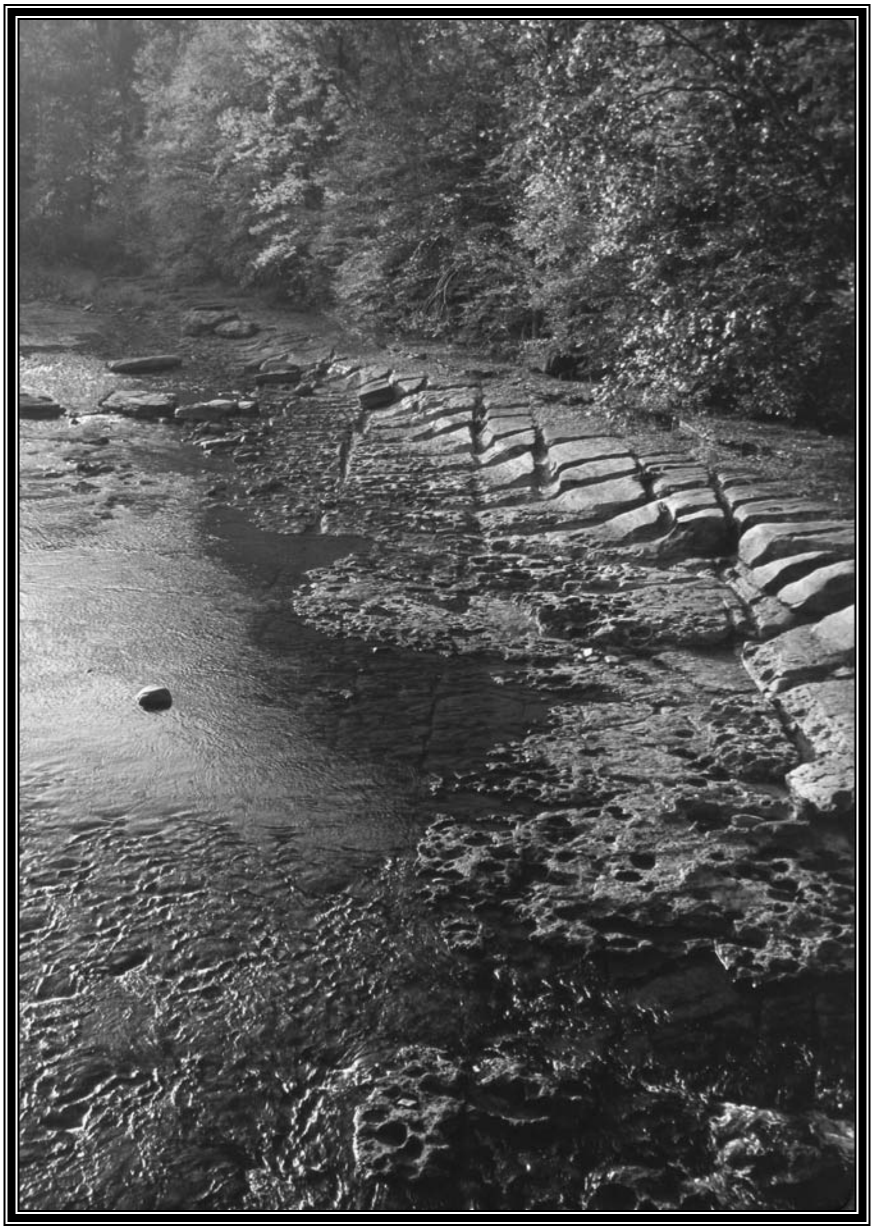
Overall, the outcomes are relatively similar between the alternatives, with viability outcomes A, B, and C identical between all alternatives. The alternatives differ slightly by the viability outcomes for D, E, and F due to differences in the management prescriptions and suitable timber lands by alternative. Some watersheds that had suitable timber lands in Alternative 1, had zero suitable acres in Alternatives 2, 2M, 3, and 4. This relationship resulted in a lower potential risk to aquatic species in those watersheds, and shifted the viability outcomes.

The predominantly low outcomes may be a reflection of the disturbance history and degraded habitat conditions the species have experienced, the influence of other limiting factors, or potentially the result of the sampling data and reporting (e.g., some areas are sampled more than others, some species are more readily captured than others, etc.). We suspect that some species are more common than reported, but the records in the WVDNR fish sampling database and Heritage database do not necessarily support that conclusion. It also stands to reason that a viability assessment for species that are recognized as species of concern or locally rare is, by definition, an assessment for species whose numbers are limited to begin with, and therefore their populations are more vulnerable to disturbance.

Similar to brook trout, the preference for aquatic species viability is to reduce the potential effects associated with land management activities that might limit their productivity. This is especially true in watersheds that support large numbers of species of concern. In this regard the Upper Greenbrier River (12 species), Williams River (12 species) and Greenbrier River 1 (10 species) could be considered hot spots for aquatic species of concern.

There are other factors and values associated with these and other watersheds that also need to be considered when setting watershed restoration priorities, such as current conditions, designated uses, ownership patterns, restoration potential, and potential costs. The aquatic diversity values associated with the Upper Greenbrier River and Williams River watersheds are part of the reason why recent watershed assessments and restoration efforts have been targeted in those watersheds. Road improvements, road decommissioning, and culvert inventories have all been conducted in the Upper Greenbrier River in recent years. A watershed assessment in the upper Williams River watershed was completed in 2000, and watershed improvement projects are being planned and designed for implementation in 2007.

Watershed, riparian, and aquatic resource management direction is similar for the alternatives and would provide protection of these resources at the project level. Mitigation measures and modification of project design can be used to address site-specific concerns, including not implementing projects due to the sensitivity of the area or the potential impacts on aquatic species of concern. Project-level decisions are not based solely on what is best for aquatic resources, so effects can and do occur to aquatic resources in order to achieve other resource management objectives. Those effects are considered tolerable as long as they are within the limits prescribed by applicable laws, regulations, policies, and Forest Plan direction.



Dry Fork near Otter Creek

Terrestrial Ecosystem Diversity (Coarse Filter)

INTRODUCTION

The Monongahela National Forest (MNF) is located in the central Appalachian Mountains, which is one of the major regional concentrations of native biological diversity in the eastern United States (The Nature Conservancy 2003). Variations in elevation, topography, geology, soils, and climate produce a wide range of ecological communities that support a great diversity of plant and animal species. Low-elevation river valleys support species typical of the southeastern and mid-Atlantic United States, while high-elevation ridges and wetlands support species that are commonly found in New England and southeastern Canada. On the western two-thirds of the Forest, up-slope precipitation supports moist, highly productive communities. The eastern third of the Forest lies in the rain shadow of the Allegheny Mountains and is dominated by drier, less productive ecosystems. Within these general areas, variations in slope and aspect produce a mosaic of forested communities. Throughout the Forest, unusual combinations of topography and geology create unique communities such as bogs, shale barrens, and rock outcrops.

Various laws and regulations address the maintenance and recovery of biological diversity on national forests. The National Forest Management Act (NFMA) and its implementing regulations require national forests to preserve and enhance the diversity of plant and animal communities to meet multiple use objectives based on the suitability and capability of the land. NFMA regulations also require maintenance of viable populations of existing native and desirable non-native species (16 U.S.C. 1600(6)(g)(3)(B); 36 CFR 219.19, 219.26, and 219.27(g)). Conserving native ecosystem diversity is a large part of the Forest Service's strategy for maintaining species viability.

Ecosystem diversity was not identified as a major Need for Change issue. However, Vegetation Management and Remote Backcountry were identified as major issues. Efforts to address these issues could influence the Forest's strategy for conserving ecosystem diversity. Public and internal comments identified the following topics that have been incorporated into the Ecosystem Diversity, Vegetation, or Remote Backcountry analyses: old growth, forest habitat fragmentation, prescribed fire, wildlife, roadless areas, biodiversity, ecosystem approach to management, and age class distribution. Efforts to address these topics form the framework within which the Forest works to conserve ecosystem diversity.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect the amount, distribution, structure, and composition of ecological communities.

Background

Ecological communities are the foundation of biological diversity. Communities on the Forest include those in need of ecological restoration, such as spruce forests and oak forests, as well as unique communities in need of protection, such as bogs and shale barrens. A key function of forest planning is to provide for such restoration and protection needs while also providing a mix of diverse habitats to meet the demands of multiple uses.

To address the requirements for maintaining diversity and viable populations, the Forest Service has developed an analysis process called species viability evaluation. Species viability evaluation takes a two-part approach that is referred to as a "coarse-filter/fine-filter" approach (Haufler et al. 1999), or an "ecosystem diversity/species diversity" approach. Coarse-filter analysis refers to evaluating biodiversity conservation through a classification and assessment of the component ecosystems that make up a landscape (Haufler et al. 1996). It is based upon the theory that conserving an adequate representation of natural plant and animal communities will maintain most species that occur in a given planning area (Haufler et al. 1999). In conserving representative communities, natural disturbance regimes and the historic range of variability of natural communities are considered (Haufler et al. 1999). The historic range of variability, generally defined as the range of communities and forest age classes that existed prior to settlement, represents conditions to which native species and communities are best adapted. It measures how close the coarse-filter strategy comes to providing representation of natural communities.

This analysis focuses on ecological communities that predominate on the landscape; communities that are rare, unique, or declining; and communities that provide habitat for species with potential viability concerns. Communities were evaluated for direct effects of management on National Forest System (NFS) land. Communities and the species that inhabit them also are affected by activities on intermingled non-NFS land; therefore, the cumulative effects of Forest Service and other activities were evaluated to the extent possible for all land within the Forest boundary (proclamation boundary and purchase units).

Indicators

The following indicators are used to reflect the potential changes by alternative based on anticipated levels of management activities that could affect ecosystem diversity components:

Amount and development stages of major forested communities by alternative - Major forested communities cover most of the land area within the Forest boundary. These major communities provide the bulk of the wildlife habitat on the Forest.

Amount of each rare and unique community potentially affected by alternative - In addition to the major forested communities, many rare or otherwise unique communities exist on the Forest. Most rare and unique communities do not cover large areas of the Forest; however, they are important habitats for many specialized, disjunct, and endemic species. For each alternative, the projected amount of each rare and unique community is evaluated relative to presettlement, post-extractive logging, and current conditions.

Representation of ecological communities in Minimum Dynamic Area (MDA) Reserves by alternative (potential old growth) - Conservation planners use the term "minimum dynamic area" (MDA) to refer to the minimum size necessary for an ecological reserve to absorb natural disturbances and still maintain all forest development stages over the long term (Frelich 1995, cited in Haney et al. 2000). Each plan alternative contains Management Prescriptions (MPs) and other direction that will prohibit or greatly limit even-aged timber management on certain areas of land. These areas, if large enough, are considered MDA reserves or potential old growth.

Scope of the Analysis

Direct, indirect, and cumulative effects are analyzed for the three indicators described below over the short and long term.

Amount and Development Stages of Major Forested Communities - Effect to the following major forested communities are analyzed:

- Spruce Forests
- Mixed Mesophytic and Cove Forests
- Northern Hardwood Forests
- Hemlock Forests
- Oak Forests
- Pine-Oak Forests
- Riparian Forests

The Current Conditions section describes these communities.

Amount of Each Rare and Unique Community - Effects to the following rare and unique communities are analyzed:

- Bogs, Fens, Seeps, and Seasonal Ponds
- Open Wetlands
- Stream Channels
- Glades and Barrens
- Rock Outcrops and Cliffs
- High Elevation Grassland
- Shrub Balds
- Caves and Mines
- Woodlands, Savannas, and Grasslands
- Remote Habitat
- Lakes and Ponds

Estimation methods varied by community according to the amount and type of information available. The Current Conditions discussion below contains descriptions of the rare and unique communities and the methods used to estimate them.

Representation of Ecological Communities in Minimum Dynamic Area (MDA) Reserves – Potential Old Growth - Areas analyzed or considered as MDAs include the following:

- Congressionally designated wilderness areas (MP 5.0).
- Proposed wilderness (MP 5.1).

- Remote backcountry (MP 6.2).
- Certain special areas (MP 8.x) that were designated for preserving biological or scenic qualities.
- Potential spruce restoration areas within MP 4.1.
- Under the action alternatives, much of the NRA, in which scenic and recreational management is emphasized.
- Suitable habitat for the West Virginia northern flying squirrel.
- Key areas near Indiana bat hibernacula.
- Corridors for eligible Wild and Scenic River status.
- Certain areas with a Scenery Management System (SMS) classification of very high scenic integrity.
- Lands classified as tentatively unsuitable for regulated timber production.

While each of these areas was allocated for specific purposes other than general conservation of biodiversity, when viewed together, they perform an additional function in the Forest's strategy for coarse-filter conservation of ecological communities. Within these areas, vegetative composition and structure will be shaped largely by natural succession and disturbance processes, or management activity will tend to mimic these processes. Over time, these areas are expected to develop a large component of old growth, so they constitute the Forest's primary strategy for providing this habitat component.

In many places, lands covered by these MPs and management direction cover large areas, and the various categories often adjoin and overlap each other. Therefore, the areas will perform the coarse-filter function of preserving large core areas containing representative examples of natural communities that can trend toward presettlement conditions. Over the long term, reserves smaller than the MDA are not expected to be effective at maintaining all forest development stages and their associated biodiversity. The MDA reserves indicator assesses the number and size of reserves provided by each alternative, as well as the degree to which the major forested communities are represented in reserves.

CURRENT CONDITIONS

Amount and Development Stages of Major Forested Communities

Community Descriptions

Spruce Forest - This community consists of high-elevation forests dominated by spruce (*Picea* spp.), or a mixture of northern hardwoods with at least 30 percent spruce in the overstory. Native red spruce (*Picea rubens*) is the tree species that dominates most areas of the spruce forest community, but where they occur, plantations of non-native Norway spruce (*Picea abies*) are also included. Mixed hardwood/spruce forests were included in this community because they tend to harbor many of the same species with potential viability concerns as pure spruce forests. The 30 percent spruce threshold was chosen because research suggests that the probability of occurrence of the endangered West Virginia northern flying squirrel (*Glaucomys sabrinus* *fuscus*) increases rapidly as conifer overstory exceeds 30 percent (Menzel et al. undated). Thus, 30 percent approximates the point at which mixed forests resemble spruce forests structurally and the associated fauna appear regularly. Selection of the 30 percent threshold for this analysis does not change the way the Forest currently identifies suitable West Virginia northern flying squirrel habitat for project-level analyses. Generally, 10 percent spruce in the overstory is used for these analyses to be conservative and capture all possible habitat.

Mixed Mesophytic and Cove Forest - Mixed mesophytic and cove forests are deciduous forests on mesic sites at low and middle elevations. Plant species composition is diverse and varies widely, though sites in this community usually lack strong components of yellow birch (*Betula alleghaniensis*) or oaks, other than northern red oak (*Quercus rubra*). This is a broad definition that probably includes many beech-maple (*Fagus grandifolia-Acer* spp.) stands that could be considered northern hardwoods. These stands were included in the mixed mesophytic and cove forests community because their habitat characteristics are more similar to other forest types in this community than they are to the very moist, high-elevation northern hardwood sites that have a strong yellow birch component.

Northern Hardwood Forest - This community consists of cool, mesic deciduous forests at middle to high elevations. As defined here, northern hardwood forests differ from mixed mesophytic and cove forests by occurring on moister sites at higher elevations, by containing a stronger component of yellow birch, and by being more likely to contain minor amounts of red spruce. Mixed stands containing 30 percent or more spruce in the overstory are included in the spruce forests community.

Hemlock Forest - Hemlock forests are dominated by eastern hemlock (*Tsuga canadensis*) or a mixture of hemlock and eastern white pine (*Pinus strobus*). Hemlock forests tend to occur in moist coves. Although hemlock forests currently cover a minor percentage of the Forest, they were included as a major forest community because historic information suggests that they were more widespread prior to initial logging of the area (Abrams and McCay 1996).

Oak Forest - This community consists of dry to mesic sites dominated by oaks (*Quercus* spp.). Prior to widespread fire suppression, such sites typically were subjected to moderate levels of recurrent disturbance, often consisting of periodic low-intensity surface fires. Such fires are thought to favor oak regeneration by creating or maintaining canopy openings and by killing seedlings of shade-tolerant, fire-sensitive tree species (Abrams and McCay 1996, Abrams et al. 1997, Schuler and McClain 2003).

Pine-Oak Forest - Pine-oak forests are dominated by pines or a mixture of pines and oaks. They typically occur on xeric or dry-mesic sites, often on ridge tops or in association with rock outcrops. In the absence of fire suppression, some yellow pine sites may be maintained in a semi-open condition by frequent low to moderate intensity fires. Forests dominated by white pine or white pine-oak mixtures are also included in this community. White pine sites may be less xeric and are less prone to frequent fires than yellow pine sites.

Riparian Forest - Riparian forests occur along streams. Typically they are dominated by a wide array of mesophytic deciduous trees, but conifer species such as eastern hemlock, eastern white pine, and red spruce also are important components of many riparian forests.

Amount and Development Stage Breakdown

We assessed communities for four important time periods. The first period was presettlement, generally defined as the time prior to widespread European settlement. This time period represents communities that existed prior to large-scale alteration by non-indigenous people, and it serves as a baseline against which other time periods are evaluated. The second period evaluated was the end of the extensive logging era that occurred during the late 19th Century and early 20th Century. This period represents the greatest historical departure from presettlement conditions for most communities. Current conditions are the third time period for which communities were evaluated. Current conditions represent the starting point for evaluating the effects of Forest Plan alternatives on ecological communities. Finally, projected conditions for each alternative were assessed through a 100-year planning horizon. Analysis of communities for the entire planning horizon allowed us to evaluate the effects of management through a period when existing forest communities will age substantially relative to current conditions. The entire planning horizon also allowed time for management strategies to make progress toward desired conditions. Limiting the analysis to the early decades of the planning horizon would have ignored important changes in the age structure of forested communities in later decades that will result from the current condition and the effects of management activity in the early decades. However, projections beyond the first decade or two must be viewed with caution because of the potential for changes in management emphasis, as well as substantial uncertainty over factors beyond the control of the Forest, such as continued acid deposition, global climate change, and human population growth.

The species viability chapter of the Analysis of the Management Situation contains additional details on the methods used to identify and classify ecological communities.

Analysis of the major forested communities proceeded as a two-step process. The first step was to estimate the total amount of each community for each time period that was assessed. Data sources for these estimates differed according to the time period considered. Estimates for presettlement amounts were based largely on the Forest's Ecological Land Type Phase (ELTP) mapping (USDA Forest Service 2002a), which projects potential natural vegetation for all land within the Forest boundary. Because the current forest is largely a product of the stands that regenerated following widespread extractive logging in the late 19th and early 20th Centuries, the Forest's Combined Data System (CDS) stands database was used to estimate major forested communities for the post-extractive logging and current time periods. Forest Inventory and Analysis (FIA) data for private lands were used to supplement current estimates for all land within the Forest boundary (data obtained from FIA website). Spectrum model outputs were used to estimate future amounts of major forested communities under each alternative. The species viability chapter of the Analysis of the Management Situation contains additional details on the methods used to estimate amounts of major forested communities.

The second step in the analysis of major forested communities was to break down the total estimates into development stages. Forested communities were divided into three stages based on the type of structural habitat provided.

Young stands occur on recently disturbed sites that are regenerating. For the purposes of this analysis, young stands include herb, seedling, sapling, and small pole stands (0-39 years old). These structural categories were combined as a way of keeping the number of habitat type/development stage combinations down to a manageable level. While we recognized that there are differences in habitat structure and associated species among these structural categories, we felt these categories are more similar to each other than they are to later development stages. Many thicket-associated species occur in these young forests. This definition of the young forest stage includes the early successional (0-19 years) and early-mid (20-39 years) successional stages that are used in other sections of this EIS.

The second development stage evaluated was the mature forest stage. Mature forests consist of large pole and sawtimber stands (40-120 years old). While forests in this stage generally are even-aged and lack an extraordinary degree of vertical habitat complexity, habitat structure can vary considerably depending on site conditions and disturbance history. These forests are characterized by species that prefer closed-canopy conditions. The mature stage includes the mid successional (40-79 years) and mid-late successional (80-120 years) stages that are used in other sections of this EIS. However, for this analysis, these stages were combined for economy at the coarse filter scale. While the mature stage covers a large range of ages, habitat structure within a given community type tends to be similar across much of this age range, while differing noticeably from younger and older forests.

The third development stage is old forest. Old forests are late-successional stands (120+ years old) that typically are uneven-aged with a high degree of vertical and horizontal habitat complexity, including canopy gaps and well-developed midstory and understory vegetation. Old forests correspond to Runkle’s (1996, modified from Oliver 1980) canopy replacement stage, which is characterized by gap-phase regeneration of individual trees or small groups of trees.

For each of these development stages, ages refer to time elapsed since the stand was last disturbed heavily enough to establish a new overstory, and not necessarily to the age of all of the dominant trees. Thus, recent two-age harvests and clearcuts with reserve trees are considered young forests, even though they still contain some older trees. Likewise, a stand that has entered the gap-phase regeneration stage may have a substantial component of young trees, but it is still considered an old stand if the last stand-scale disturbance occurred more than 120 years ago.

For presettlement conditions, development stage breakdowns were estimated based on a review of estimates of return intervals for stand-replacing windstorms and fires in the northeastern United States (Lorimer and White 2003). Because most current stands originated during the extractive logging period in the late 19^{th} and early 20^{th} Centuries, development stages for the post-extractive logging period and the current period were estimated using stand origin dates in the CDS database. Future development stage distributions under each alternative were projected based on Spectrum model outputs. The species viability chapter of the Analysis of the

Management Situation contains additional details on the methods used to estimate development stages of major forested communities.

Presettlement Period - During presettlement times within the Forest boundary (regardless of current ownership), mixed mesophytic and cove forest was the most extensive community type, covering an estimated 670,000 to 760,000 acres, or 40 to 45 percent of the landscape (Figure ED-1). Oak forest and spruce forest were also extensive, with oak forest covering an estimated 350,000 to 360,000 acres (21 percent of the landscape) and spruce forest covering an estimated 170,000 to 430,000 acres (10 to 25 percent of the landscape). It is likely that areas identified as oak forest had a substantial component of American chestnut (*Castanea dentata*) (Abrams and McCay 1996). Hemlock forest covered a total estimated area of 120,000 to 150,000 acres (7 to 9 percent of the landscape). Pine-oak forest was estimated at 68,000 acres (4 percent of the landscape). This likely is an underestimate considering historic accounts that tell of large areas of white pine in the river valleys in the southeastern part of the Forest (Brooks 1911). White pine was reduced to a minor component in many of these areas by historic logging and fires. Because of a current lack of white pine potential, the ELTP mapping may have missed some of these areas. Northern hardwood forest was estimated at 0 to 130,000 acres (0 to 8 percent of the landscape). Riparian forest, which overlaps the other communities, was estimated at 130,000 acres (8 percent of the landscape). When only current NFS land was considered, the landscape percentages were similar, though spruce forest was slightly more prominent and mixed mesophytic and cove forest was slightly less prominent, due to the concentration of NFS land in higher elevations (Figure ED-2).

The forest development stage analysis suggested that, as a whole, presettlement forested communities were overwhelmingly dominated by old stands (120+ years old). Old forest stands are estimated to have covered somewhere between 69 and 87 percent of the landscape (Figures ED-3 and ED-4). Young forest stands (0 to 39 years old) probably covered 4 to 12 percent of the landscape, while mature stands (40 to 120 years old) were estimated to have covered about 7 to 18 percent of the landscape. Not surprisingly, the old stages of the three most widespread forest communities were estimated to have been dominant, with old mixed mesophytic/cove forest covering between 27 and 40 percent of the landscape, old oak forest covering 15 to 20 percent of the landscape, and old spruce forest covering 6 to 29 percent of the landscape (Figures ED-5 and ED-6).

These estimates of presettlement forested communities and development stages should be interpreted cautiously. Although they were constructed using the best available information, it is important to remember that they are based on limited empirical data. The ELTP mapping that formed the basis of the community classification was constructed from soil mapping, geological mapping, and botanical data collected in representative sites (USDA Forest Service 2002a). However, the determination of potential natural vegetation for ELTPs required a substantial component of professional judgment. The disturbance regimes used to estimate amounts of the forest development stages were constructed from disturbance return interval data (Lorimer and White 2003, and references therein), but the data came from similar forest types in other areas. Therefore, these estimates should be considered approximations based on limited available information.

Post-Extractive Logging Period - On current NFS land, three forested communities were most dominant following the extractive logging period that occurred during the late 19th and early 20th Centuries. Mixed mesophytic and cove forest was estimated to cover approximately 360,000 acres (39 percent of the landscape), while oak forest covered about 250,000 acres (27 percent of the landscape) and northern hardwood forest occupied approximately 180,000 acres (20 percent of the landscape). The other major forested communities each covered less than 10 percent of the landscape.

Compared to estimated presettlement conditions, coverage by northern hardwood forest, oak forest, and pine-oak forest appears to have increased after extractive logging, while the extent of spruce forest and hemlock forest appears to have decreased greatly (Figure ED-2). Such changes are consistent with historical accounts of the conversion of mesic, conifer-dominated communities to northern hardwood and oak-dominated communities following logging, soil erosion, and fires (Stephenson 1993). However, caution must be exercised in interpreting these apparent changes because of the different methods used to estimate presettlement versus 1935 community coverage. It is possible that an unknown portion of the apparent changes could be due to methodological biases. The apparent decline of hemlock forest may be at least partially an artifact of the way stands are typed in the CDS database. Hemlock tends to occur in small groves, which may have been included in larger hardwood stands.

The forest development stage analysis indicated that in 1935, current NFS land was overwhelmingly dominated by young forest stands. Considering all of the major forest communities together, young stands were estimated to have covered an estimated 82 percent of the landscape, with mature forests occupying about 13 percent of the landscape and old forests virtually nonexistent (Figures ED-4 and ED-5). The remaining 5 percent of the landscape is presumed to have been non-forested, but this likely underestimates non-forested areas due to overlap of the forest types in the stands layer with areas identified as non-forest using other sources. Other sources used to identify some of the rare and unique communities indicated that about 73,000 acres (8 percent) of current NFS land was non-forested in the mid 1930s (see Table ED-3 in the Rare and Unique Communities section). Although not directly estimated due to lack of information for private lands, it is reasonable to assume that because of the widespread logging that occurred, forested stands on current non-NFS land within the Forest boundary also would have been heavily dominated by young stands. However, because current non-NFS land is concentrated in the lower, flatter areas, it is likely that a higher proportion of that land was non-forested agricultural land.

Current Period - Because the current forested communities are largely the result of stands that regenerated after extractive logging in the late 19th and early 20th Centuries, and the same CDS forest type data were used for estimating 1935 and current conditions on NFS land, the estimated total amounts of current forested communities are very similar to the 1935 estimates, and the same three communities still are overwhelmingly dominant on the landscape (Figures ED-1 and ED-2). The most extensive current forested community is mixed mesophytic and cove forest, covering approximately 360,000 acres (39 percent of the landscape) on NFS land and approximately 620,000 acres (36 percent of the landscape) on all land within the Forest boundary. Oak forest is the next most extensive forested community, occupying about 250,000 acres (27 percent of the landscape) on NFS land and about 370,000 acres (22 percent of the landscape) on all land in the Forest boundary. Northern hardwood forest is still the third most dominant community, covering about 170,000 acres (18 percent of the landscape) on NFS land and 350,000 acres (21 percent of the landscape) on all land within the Forest boundary. However, because we included mixed hardwood-spruce stands in the spruce community for the estimate of current conditions, the acreage classified as northern hardwoods decreased slightly compared to the 1935 estimate, while the acreage classified as spruce increased slightly. Relative to estimated presettlement conditions, spruce forest and hemlock forest still appear to be greatly reduced in extent, whereas northern hardwood forest, oak forest, and pine-oak forest still appear to be more extensive.

Currently, mature forest stands dominate most of the landscape within the Forest boundary (Figures ED-3 through ED-6). On NFS land, mature forests (all communities combined) are estimated to cover approximately 770,000 acres (84 percent of the landscape). On all land ownership within the Forest boundary, mature stands cover about 1.28 million acres (75 percent of the landscape). Such dominance by mature stands contrasts greatly with the estimated 7 to 18 percent coverage by mature stands during presettlement. This overwhelming dominance by mature forest is a direct result of aging of the stands that regenerated following extractive logging in the late 19th and early 20th Centuries.

The total area of young forest stands has declined greatly since 1935 (Figures ED-3 through ED-6). Young stands now cover approximately 64,000 acres (7 percent of the landscape) on NFS land and approximately 160,000 acres (9 percent of the landscape) on all lands within the Forest boundary. Thus the area covered by young stands has declined to within the range estimated for presettlement conditions (Figures ED-3 and ED-4).

Total area of old forest stands has increased since 1935, but old forests still cover only about 38,000 acres (4 percent of the landscape) on NFS land and about 50,000 acres (3 percent of the landscape) on all lands within the Forest boundary (Figures ED-3 through ED-6). The extent of old forest is still far below the estimated presettlement extent (Figures ED-3 and ED-4).

Figure ED-1

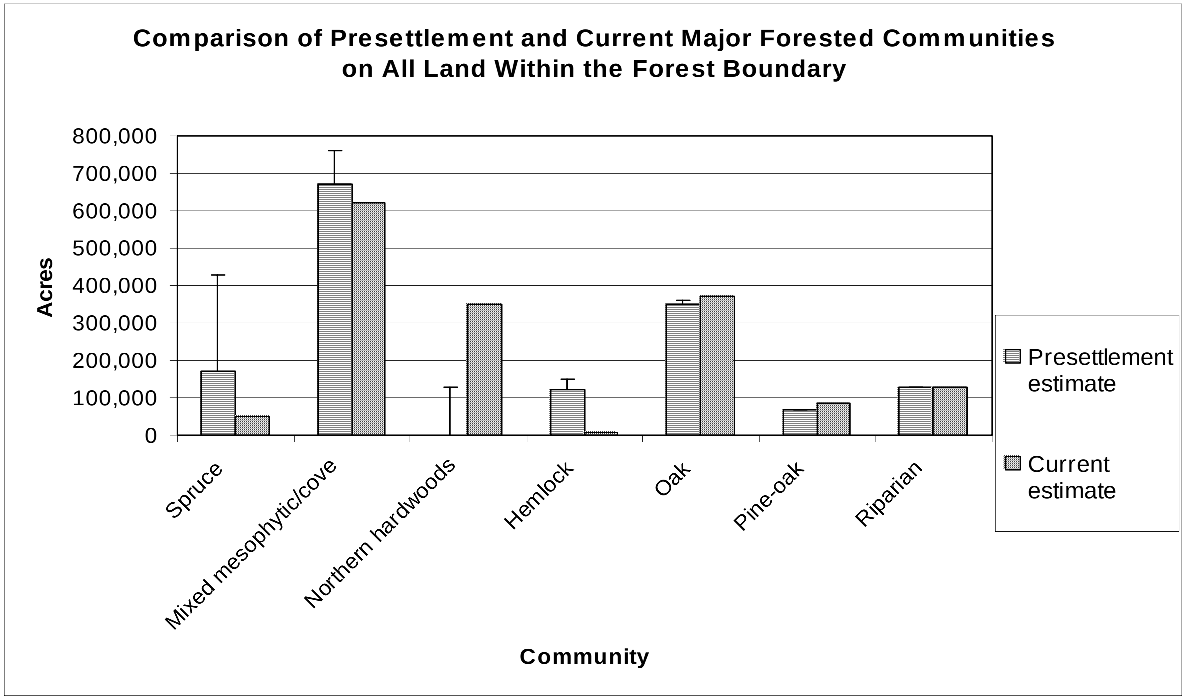


Figure ED-2.

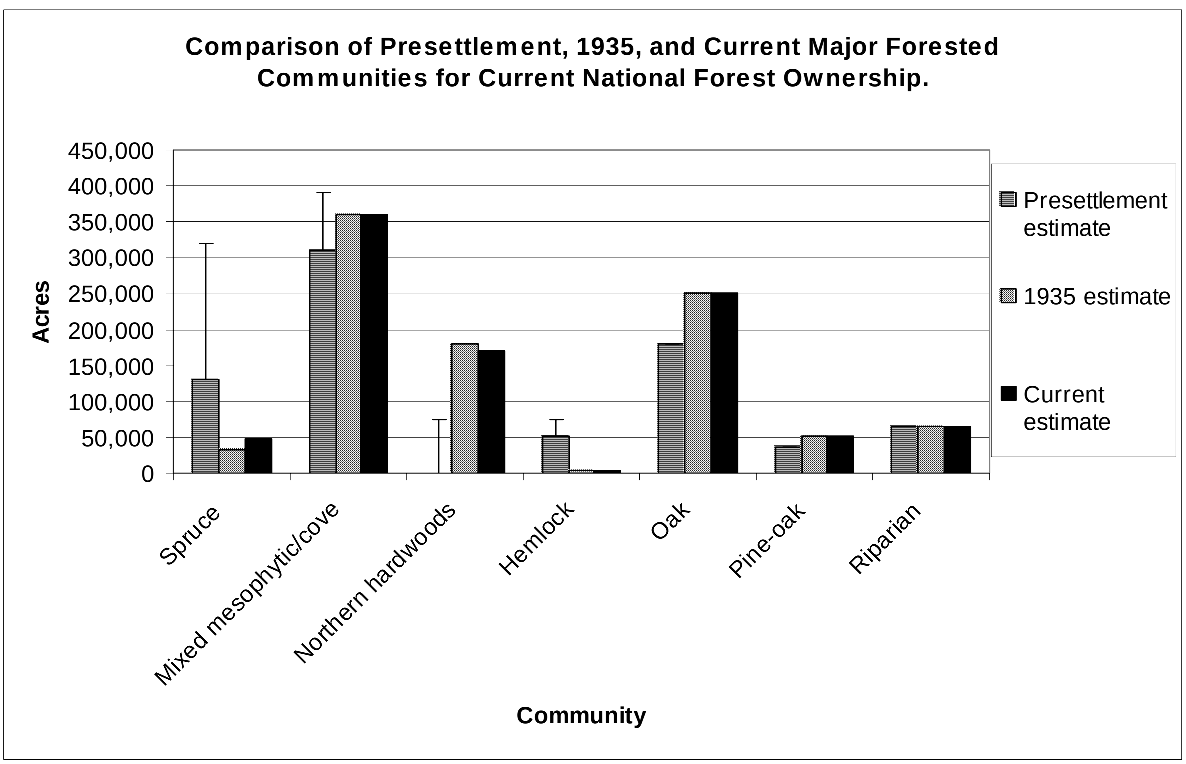


Figure ED-3.

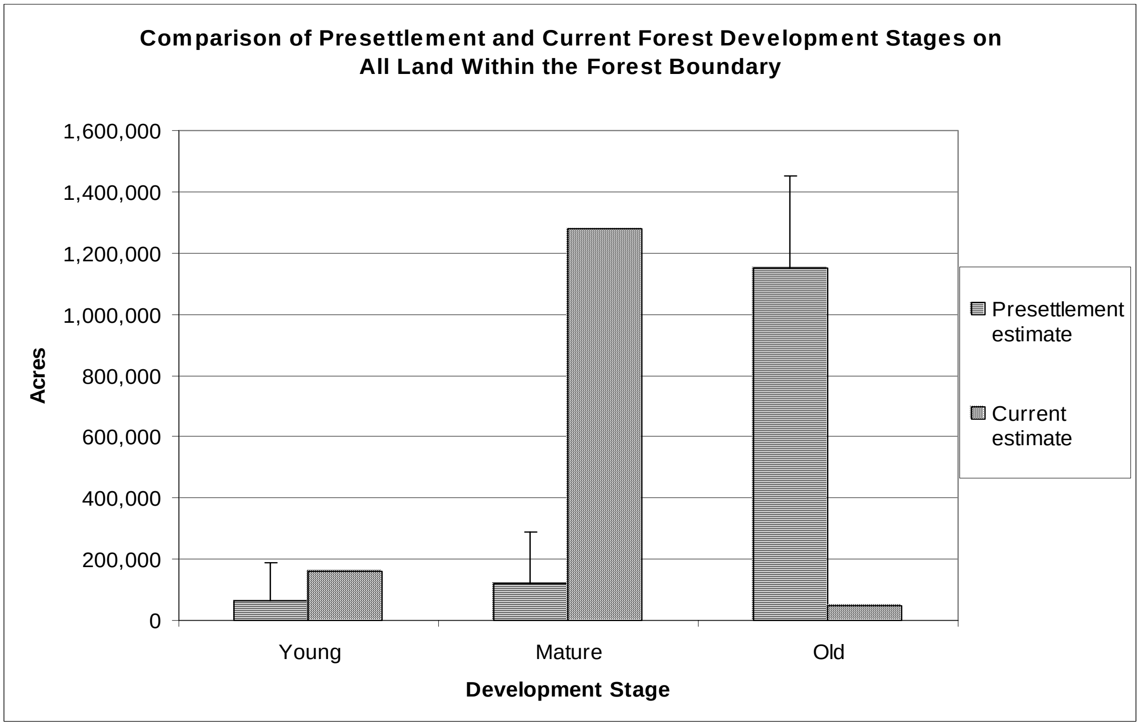
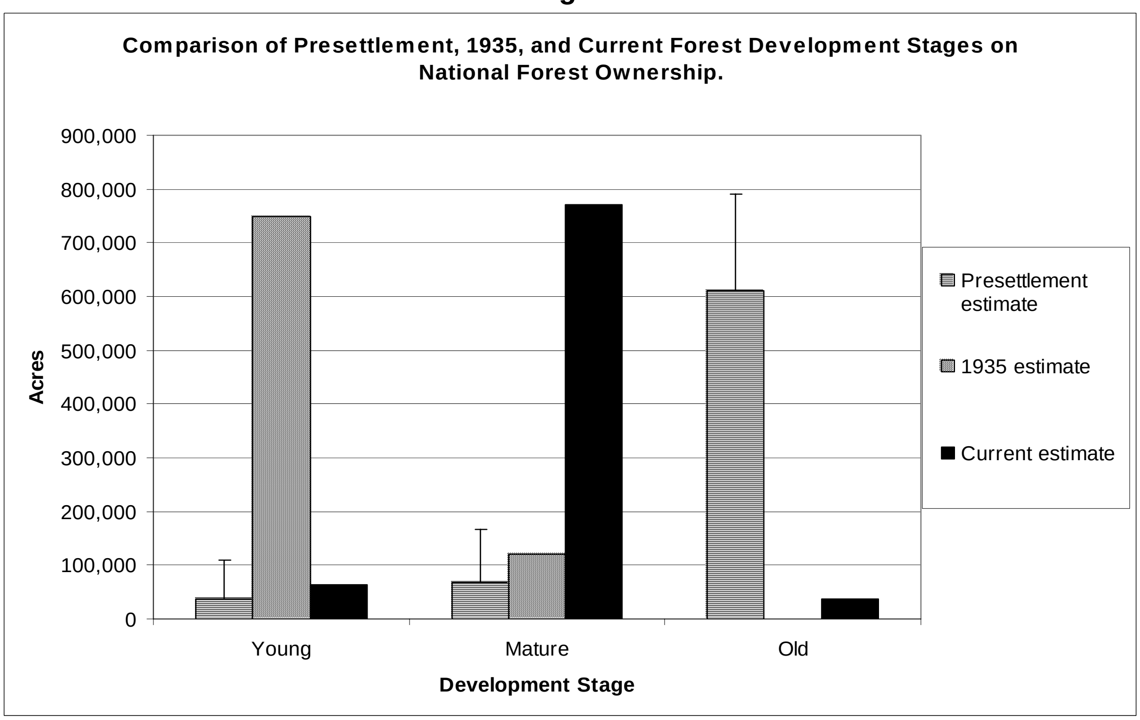


Figure ED-4.



Young = 0-39 years, Mature = 40-120 years, Old = 120+ years.

Figure ED-5.

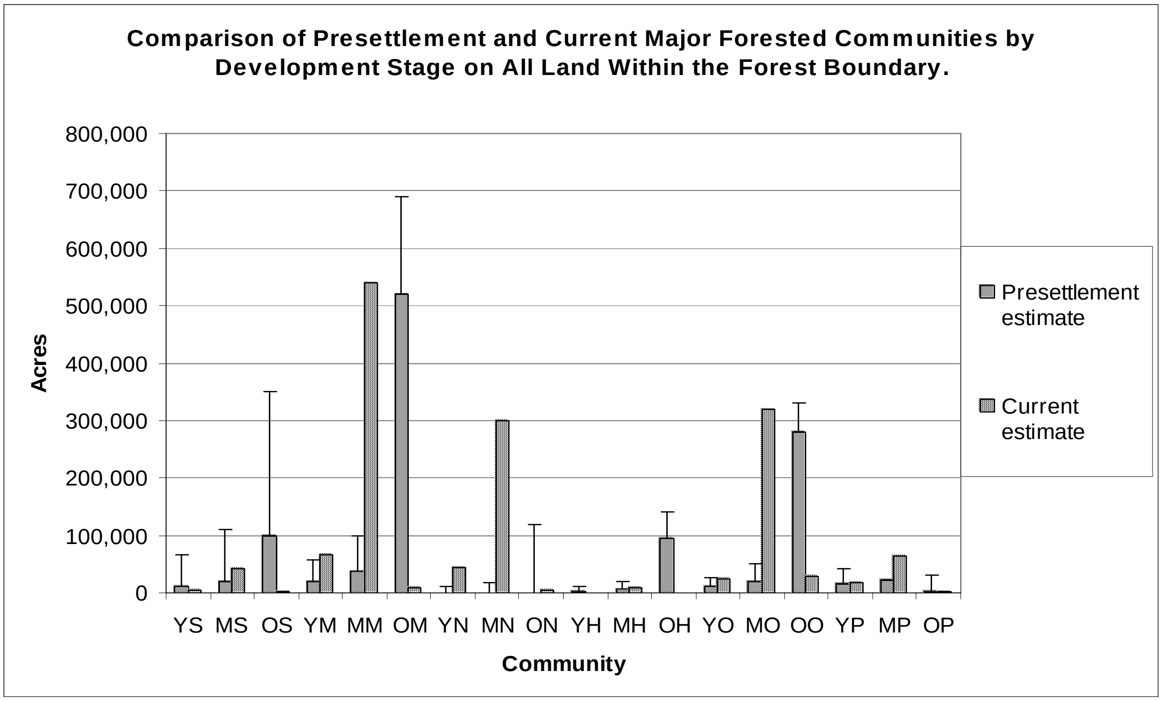
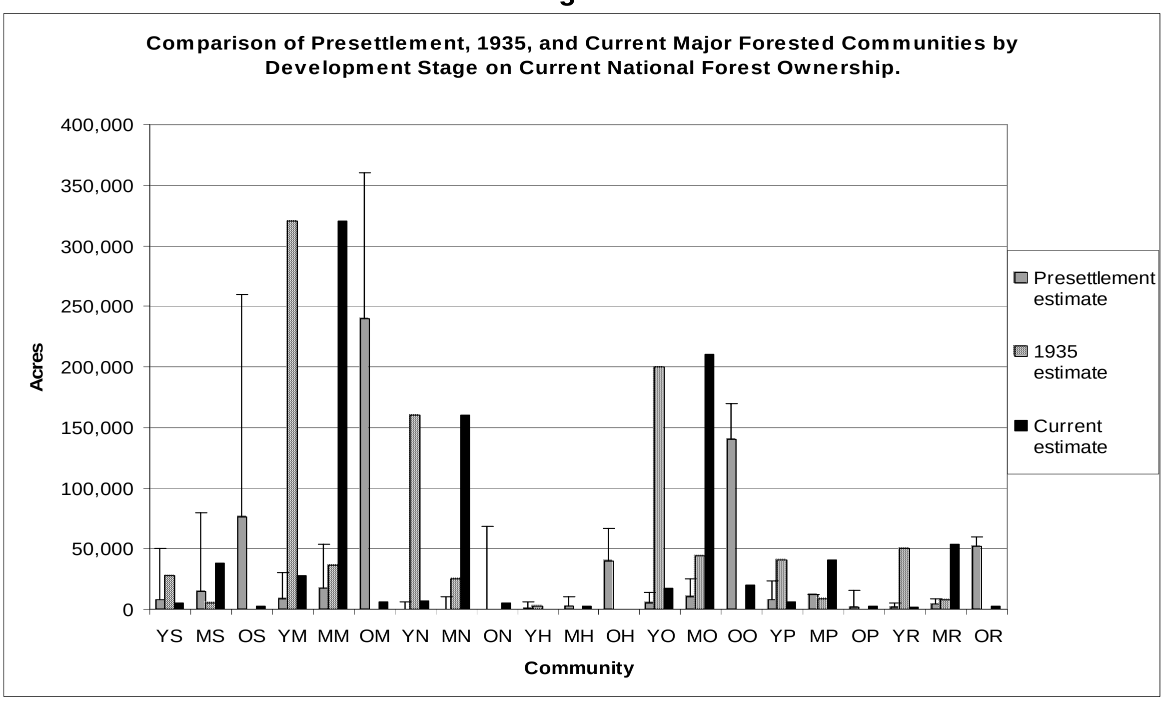


Figure ED-6.



First letter of community abbreviation refers to forest development stage: Y = young (0-39 years), M = mature (40-120 years), O = old (120+ years). Second letter refers to community: S = spruce, M = mixed mesophytic/cove, N = northern hardwoods, H = hemlock, O = oak, P = pine-oak, R = riparian.

Amount of Rare and Unique Communities

Bogs, Fens, Seeps, and Seasonal Ponds

Bogs, fens, seeps, and seasonal ponds consist of non-riverine wetlands characterized by saturated or seasonally ponded soil. Non-alluvial wetlands, as well as alluvial wetlands located outside of active stream channels, are included in this community. Coverage by emergent woody or herbaceous vegetation is more or less continuous. Areas of this habitat may or may not have a closed tree canopy depending on the length of the annual period of saturation or ponding. Area of this community was estimated using National Wetland Inventory (NWI) mapping of palustrine scrub-shrub and palustrine forested wetland types (Cowardin et al. 1979).

This community currently covers an estimated 6,000 acres on all ownerships in the Forest boundary (Table ED-1). Bogs, fens, seeps, and seasonal ponds on NFS land were estimated at 2,000 acres (Table ED-2). It is likely that the NWI mapping missed small wetlands; therefore these estimates may underestimate the true extent of this community on the Forest.

No reliable information was available to allow estimation of presettlement or post-extractive logging amounts of this community. For the analysis of alternatives, future amounts of this community were assumed to remain similar to current amounts for all alternatives. This assumption is based on the fact that wetlands are protected by Clean Water Act permitting and mitigation requirements, and by Forest-wide standards and guidelines on NFS land.

Open Wetlands

Open wetlands include marshes and shallow areas of open water. They are characterized by long annual periods of inundation or saturation, which prevent formation of closed tree canopies. Open wetlands can occur in association with bogs, fens, seeps, and seasonal ponds; in beaver impoundments; or along the shorelines of man-made lakes and ponds. Area of this community was estimated using NWI mapping of palustrine unconsolidated bottom, palustrine aquatic bed, palustrine unconsolidated shore, palustrine emergent, and palustrine open water wetland types (Cowardin et al. 1979).

Open wetlands currently are estimated to cover 3,000 acres on all land in the Forest boundary (Table ED-1). For NFS land only, the area of open wetlands is estimated at 1,000 acres (Table ED-2). It is likely that the NWI mapping missed small wetlands; therefore these estimates may underestimate the true extent of open wetlands on the Forest.

No reliable information was available to allow estimation of presettlement or post-extractive logging amounts of this community. For the analysis of alternatives, future amounts of this community were assumed to remain similar to current amounts for all alternatives. This assumption is based on the fact that wetlands are protected by Clean Water Act permitting and mitigation requirements, and by Forest-wide standards and guidelines on NFS land.

Stream Channels

For the purposes of the terrestrial species viability evaluation, stream channels are defined as the channels, gravel and sand bars, and banks of perennial streams. Although these are aquatic habitats, they are used by some of the terrestrial and semi-aquatic species that are covered by the terrestrial portion of the species viability evaluation. Intermittent streams were not included because of their limited ability to provide habitat for the terrestrial fine-filter species associated with this community.

Estimates of stream channel habitat were based on the National Hydrography Dataset (NHD) GIS layer for the Forest (USGS 2000). On all land within the Forest boundary, about 6,000 miles of streams were identified in this manner (Table ED-1). On NFS land only, total stream length was estimated at about 3,000 miles (Table ED-2). These estimates were used to represent presettlement, post-extractive logging, and current stream channel habitat amounts. Using the NHD layer to represent past and current conditions assumes that losses of stream reach due to culverts, channelization, and fill have been minimal. The estimate derived from the NHD layer also was used to represent future stream channel habitat under each alternative, based on the assumption that Clean Water Act protections and the Forest's standards and guidelines will minimize potential losses of stream reaches.

Glades and Barrens

Glades and barrens are areas characterized by sparse or stunted vegetation due to shallow soil, low soil fertility, harsh climatic conditions, exposed parent material, or some combination of these factors. The extent of these areas was estimated using the ELTP GIS layer. Areas identified in the ELTP layer as limestone glades or shale barrens were considered to represent the glades and barrens community. Because glades and barrens are poorly suited for most traditional land uses, their extent likely has changed little over time, and future land uses are unlikely to impact them. Therefore, the ELTP estimate was used to represent the presettlement and post-extractive logging extent of glades and barrens, as well as the current extent and future extent under all alternatives. By this method, glades and barrens were estimated to cover about 5,000 acres within the Forest boundary, and about 2,000 acres on NFS land (Tables ED-1 and ED-2). All glades and barrens shown on the ELTP layer are in the eastern part of the Forest. Because glades and barrens represent small inclusions in other community types, it is likely that the ELTP layer missed some occurrences of this community. Therefore, these estimates likely underestimate the true extent of the community.

Rock Outcrops and Cliffs

The rock outcrops and cliffs community consists of rock outcrops, cliffs, talus, and boulder fields characterized by exposed rock, shallow soils, and sparse vegetation. Because these rocky habitats are poorly suited to most land uses, the amount of this community was assumed to change little over time. Therefore, soils map units that indicate presence of rock outcrops were used to estimate presettlement, post-extractive logging, and current occurrences of this community. This method may have overestimated total rock outcrop/cliff habitat because the soil map units depict those soils that typically contain frequent outcrops, not the outcrops themselves. However, no other comprehensive inventory of rock outcrops and cliffs exists. Using this method, rock outcrops and cliffs were estimated to cover about 26,000 acres within the Forest boundary (Table ED-1), and about 6,000 acres on NFS land (Table ED-2). Future amounts of this community under all alternatives were presumed to remain the same, based on the general lack of management activity in this community.

High Elevation Grassland

This community consists of grassy balds, pastures, and hay fields located above 3,000 feet in elevation, often on ridge tops, summits, or exposed slopes. Current occurrences of this habitat all appear to have been created by logging, anthropogenic fires, agriculture, or some combination of these factors (Stephenson 1993), and they are maintained by livestock grazing, mowing, or soil conditions caused by past logging and fires.

Quantification of the presettlement extent of this community is difficult due to lack of information. Historic accounts indicate that scattered balds existed at the time of settlement (Maxwell 1910, Wayland 1925 cited in Stephenson 1993, Core 1966, Clarkson 1966 cited in Stephenson 1993). Core (1949, cited in Stephenson 1993) estimated that several thousand hectares of treeless areas existed in eastern West Virginia at the time of settlement. ELTPs indicating grass/forb dominance are not useful for estimating presettlement high-elevation grassland. They all occur in the Dolly Sods/Roaring Plains area, and based on historic accounts of the origin of those open areas, it appears they were once spruce forests that were converted to grassland through fires, soil erosion, and grazing (Brooks 1911).

Although grass/forb dominated ELTPs do not represent presettlement grasslands, they were useful for estimating the current extent of high-elevation grassland. These ELTPs were combined with grazing allotments, CDS stands shown as open areas, and hay/pasture/grasslands from the West Virginia Gap Analysis GIS layer (Strager and Yuill 2002). The resulting GIS layer was overlaid on the 3,000-foot elevation contour to represent high-elevation grasslands. By this method, current high-elevation grasslands were estimated at about 27,000 acres on all land within the Forest boundary (Table ED-1). Current high-elevation grasslands on NFS land were estimated at 14,000 acres (Table ED-2). Based on Core's (1949, cited in Stephenson 1993) presettlement estimate of several thousand hectares, it would appear that current amounts of this community exceed presettlement amounts. However, casual observation suggests that much of this community currently consists of heavily grazed pasture on private land, which likely does not provide the same type of habitat that was provided by presettlement occurrences of this community.

High-elevation grasslands at the end of the period of extractive logging were estimated by overlaying the 1937 land use classification provided by the West Virginia Gap Analysis program (Pohlmann 1937) on the 3,000-foot elevation contour. Land cover classes indicating hay and pasture land suggest that high-elevation grass-dominated communities covered around 81,000 acres on all ownerships within the Forest boundary (Table ED-1), and about 27,000 acres on current NFS land (Table ED-2). These estimates should be interpreted with caution because the original 1937 land cover map was drawn at a scale of 1:500,000 and its level of accuracy is unknown.

For each alternative, estimates of future high-elevation grasslands on NFS land were based on projected trends in grazing allotments, wildlife openings, and savannas. For non-NFS land, general trends in pasture and hay land were evaluated using data from the Census of Agriculture conducted by the U.S. Department of Agriculture (USDA 2004, USDA 1999).

Shrub Balds

Shrub balds are exposed, high-elevation sites that have sparse tree cover and are dominated by ericaceous shrubs. This community is limited to those areas that are permanently dominated by shrubs and does not include young seedling/sapling forest stands. Shrub balds often are interspersed with high-elevation grasslands.

The presettlement extent of this habitat is unclear. An account of the Fairfax Line survey in the 1740s indicates that a large open area existed in the Bear Rocks area near Dolly Sods (Wayland 1925). The account indicates that the ground was “marshy,” so it is likely that the open area contained bogs, as well as possibly containing shrub balds and grassy balds. Many of the historical references cited above for high-elevation grasslands do not distinguish between grass-dominated and shrub-dominated openings, so it is possible that some of these accounts refer to a combination of grass balds and shrub balds.

Current shrub bald occurrences are limited to the Dolly Sods/Roaring Plains area. Some authors believe these balds were the result of soil erosion, wildfires, and grazing during the 19th and early 20th Centuries (Brooks 1911, Core 1966), but the Fairfax Line account cited above suggests that these activities may have expanded existing shrub balds. We used ELTPs with the primary plant association code of heathland to estimate the current extent of shrub balds. These ELTPs total about 3,000 acres on all land within the Forest boundary (Table ED-1), essentially all of which is on NFS land (Table ED-2). Because this community is the result of soil conditions that are not likely to change greatly over time, these ELTPs were also used as an estimate for the post-extractive logging period and the predicted future extent of shrub balds under all alternatives.

Caves and Mines

This community consists of natural caves, as well as mines with microclimates capable of supporting cave-associated biota. Amount and distribution of cave habitat was estimated using the Forest’s GIS layer depicting cave locations. This layer indicated that there are 340 known cave openings within the Forest boundary (Table ED-1). Of these known openings, 225 of them are on NFS land (Table ED-2). Some of these are multiple openings to the same cave, and undoubtedly there are many unknown entrances. Because cave formation is a slow geologic process, current caves were assumed to be essentially permanent, and therefore were used to estimate past and future cave habitats.

Woodlands, Savannas, and Grasslands

This habitat includes open woodlands and savannas at low elevations that are characterized by low canopy cover and grass-dominated understories. Hay fields and pastures are included in this community and constitute the bulk of the acreage. These habitats are maintained in an open condition by periodic fire, mowing, grazing, or other disturbance.

The presettlement status of the open habitats was difficult to evaluate due to lack of information. For areas east of the Appalachians, there are numerous accounts of openings and savannas created by Native American agriculture and burning (e.g., Maxwell 1910). In contrast, there are very few accounts of the effects of native cultures on presettlement vegetation in eastern West Virginia. Maxwell (1910) cited an early account asserting that the Iroquois people of western New York drove out the native inhabitants of West Virginia in 1672. The land was said to have been still empty of native people when settlers arrived in the mid-1700s. A few lands were said to have still been open when the settlers arrived, and other areas in the Tygart and Cheat valleys were forested with young, even-aged stands that seemed to indicate that they had once been open. Some sources indicate that much of eastern North America was de-populated around 1500 due to disease epidemics introduced by early European explorers. This de-population may have allowed formerly cultivated land to revert to forest by the time of widespread settlement (Owen 2002). Brooks (1911) asserted that all of West Virginia was forested when settlers arrived, except for a few old Native American fields and open glades. Thus there appears to be some evidence of scattered anthropogenic savannas and grasslands prior to European settlement, but the information is not specific enough to allow estimation of the amount. It is not known to what extent non-anthropogenic grassy openings may have occurred as inclusions in fire-maintained oak and pine-oak forests, though it is possible that such habitats existed.

Estimates of current woodlands, savannas, and grasslands were based on combining data from the following sources: hayfields, pastures, and grasslands in the West Virginia Gap Analysis GIS layer; the Forest's GIS layer of grazing allotments; and CDS data on stands classified as open. The resulting layer was further stratified to include only those areas below 3,000 feet elevation (areas above 3,000 feet were included in high-elevation grasslands). Based on this estimate, current woodlands, savannas, and grasslands cover about 66,000 acres on all ownerships within the Forest boundary (Table ED-1). Casual observation suggests that most of this acreage consists of heavily grazed pastures on private land. Therefore, it is likely that current occurrences of this community provide habitat different from that provided by presettlement occurrences. Only about 7,000 acres of this community occurs on NFS land (Table ED-2).

Woodlands, savannas, and grasslands at the end of the extractive logging period were estimated by overlaying the 1937 land use classification provided by the West Virginia Gap Analysis program (Pohlmann 1937) on the 3,000-foot elevation contour. Land cover classes indicating hay and pasture land below 3,000 feet suggest that low-elevation grass-dominated communities covered around 170,000 acres on all ownerships within the Forest boundary in 1937 (Table ED-1). About 40,000 acres of this total occurred on current NFS land (Table ED-2). These estimates should be interpreted with caution because the original 1937 land cover map was drawn at a scale of 1:500,000 and its level of accuracy is unknown.

For each alternative, estimates of future woodlands, savannas, and grasslands on NFS land were based on projected trends in grazing allotments, wildlife openings, and savannas. For non-NFS land, general trends in pasture and hay land were evaluated using data from the Census of Agriculture conducted by the U.S. Department of Agriculture.

Remote Habitat

This community consists of remote habitats away from frequent disturbance by humans. Although remote habitat covered essentially the entire landscape in presettlement times, and still covers a substantial area today, it was treated with the unique communities because it represents a land-use overlay on the other communities, rather than a distinct community type.

For the purposes of this evaluation, remote habitats were defined as all areas that fall within the Recreation Opportunity Spectrum (ROS) primitive or semi-primitive non-motorized categories. See the Recreation section of this chapter for a description of the methods used to estimate ROS classifications on NFS land. On non-NFS land, an ROS map provided by West Virginia University was used to estimate the current amount of remote habitat. In the absence of quantifiable information on likely future amounts of remote habitat on non-NFS land, this estimate also was used as a maximum estimate of future remote habitat on non-NFS land under all alternatives.

Current remote habitats on all land within the Forest boundary were estimated at 280,000 acres (Table ED-1). Of this total, about 190,000 acres are on NFS land (Table ED-2).

Estimating presettlement amounts of this habitat was not an issue as the entire Forest was remote habitat at that time. Remote habitats at the end of the extractive logging period could not be estimated due to lack of information. However, given the level of activity necessary to log essentially all of the land within the Forest boundary, it is likely that much less remote habitat existed in the 1930's than exists currently. Future remote habitat was evaluated using projections of ROS classifications under the various Plan alternatives.

Lakes and Ponds

This community is comprised of lakes and ponds. Lakes and the larger ponds are largely human-created, whereas smaller ponds may be natural or human created. Natural ephemeral ponds are included in the bogs, fens, seeps, and seasonal ponds community; beaver impoundments are included in the open wetlands community. No natural lakes or large ponds exist on the Forest; therefore we presume that in terms of total area, the extent of this community was trivial during presettlement times. No data exist to allow estimation of the extent of this community at the end of the extractive logging period.

Using NHD lakes and ponds polygon data (USGS 2000), the current amount of lake and pond habitat on all land within the Forest boundary was estimated at about 700 acres (Table ED-1). Current lakes and ponds on NFS land were estimated at 200 acres (Table ED-2). It was apparent from visual inspection of the GIS layers that there is substantial overlap between the smaller lakes and ponds estimated from NHD and the open wetlands community estimated from NWI. Due to protection afforded by the Clean Water Act and Forest-wide direction, lakes and ponds habitat was projected to remain approximately constant in the future under each alternative. This may have caused a slight underestimate of future amounts because it ignores the possibility of construction of new farm ponds on private land.

Table ED-1. Comparison of Estimated Presettlement, 1935-1937, and Current Amounts of Rare and Unique Communities within the Monongahela National Forest Boundary
(NFS land and other ownership combined. All amounts are acres unless otherwise noted. "Unknown" denotes that there was no reliable way to determine this information.)

Community	Presettlement		1935-1937		Current	
	Amount	Percent of Landscape	Amount	Percent of Landscape	Amount	Percent of Landscape
Bogs, Fens, Seeps, and Seasonal Ponds	Unknown	Unknown	Unknown	Unknown	6,000	<1
Open Wetlands	Unknown	Unknown	Unknown	Unknown	3,000	<1
Stream Channels (miles)	6,000	NA	6,000	NA	6,000	NA
Glades and Barrens	5,000	<1	5,000	<1	5,000	<1
Rock Outcrops and Cliffs	26,000	2	26,000	2	26,000	2
High Elevation Grasslands	Unknown	Unknown	81,000	5	27,000	2
Shrub Balds	Unknown	Unknown	3,000	<1	3,000	<1
Caves and Mines (number of entrances)	340	NA	340	NA	340	NA
Woodlands, Savannas, and Grasslands	Unknown	Unknown	170,000	10	66,000	4
Lakes and Ponds[1]	Unknown	Unknown	Unknown	Unknown	700	<1
Total Remote Habitat	1,700,000	100	Unknown	Unknown	280,000	16

[1] This category contains substantial overlap with the open wetlands category.

Table ED-2. Comparison of Estimated Presettlement, 1935-1937, and Current Amounts of Rare and Unique Communities on Monongahela National Forest System Lands Only
(All amounts are acres unless otherwise noted. "Unknown" denotes that there was no reliable way to determine this information.)

Community	Presettlement		1935-1937		Current	
	Amount	Percent of Landscape	Amount	Percent of Landscape	Amount	Percent of Landscape
Bogs, Fens, Seeps, and Seasonal Ponds	Unknown	Unknown	Unknown	Unknown	2,000	<1
Open Wetlands	Unknown	Unknown	Unknown	Unknown	1,000	<1
Stream Channels (miles)	3,000	NA	3,000	NA	3,000	NA
Glades and Barrens	2,000	<1	2,000	<1	2,000	<1
Rock Outcrops and Cliffs	6,000	1	6,000	1	6,000	1
High Elevation Grasslands	Unknown	Unknown	22,000	2	14,000	2
Shrub Balds	Unknown	Unknown	3,000	<1	3,000	<1
Caves and Mines (number of entrances)	225	NA	225	NA	225	NA
Woodlands, Savannas, and Grasslands	Unknown	Unknown	40,000	4	7,000	1
Lakes and Ponds[1]	Unknown	Unknown	Unknown	Unknown	200	<1
Total Remote Habitat	915,000	100	Unknown	Unknown	190,000	20

[1] This category contains substantial overlap with the open wetlands category.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth

Potential reserves occur on the landscape in a wide variety of sizes, spatial configurations, and ecological settings. Therefore, it is important to consider not only the total area of land that could contribute to achieving coarse-filter goals, but also the adequacy of individual units or aggregations of units to serve as functioning biodiversity reserves.

The size of an MDA depends on the size of the disturbances that characterize a particular landscape. As a general rule of thumb, ecological reserves should be twice the size of the largest expected stand-replacing disturbance, or 50 times the size of the mean expected stand-replacing disturbance (Johnson and Van Wagner 1985, Shugart 1984 cited in Haney et al. 2000). Applying these rules to wind and fire disturbance size data from the northeastern U.S. (Seymour et al. 2002) and the southern and central Appalachians (Haney et al. 2000) produced estimated MDAs ranging from 1,200 acres to 25,000 acres (Table ED-3). We chose 10,000 acres as a representative mid-range MDA. Ten thousand acres falls near the MDA estimates produced by a maximum fire size in the central Appalachians and a mean wind disturbance size in the northeastern U.S. Therefore, this MDA size should represent communities where fire is the primary stand-replacing disturbance (e.g., pine-oak), as well as those communities where wind is the primary stand-replacement mechanism (e.g., northern hardwoods). Larger MDA estimates were not chosen given that all of the reserves exist in a matrix of moderately managed forest that offers habitat for many of the old forest species that are conserved by the reserves. This is particularly true given that the lightly managed Indiana bat primary ranges were not included in the reserves.

To identify reserves meeting the MDA, we aggregated contiguous and immediately adjacent parcels that are not likely to be subject to large-scale even-aged management (see list of MPs and other areas in indicator description above). We screened the aggregated areas using the 10,000-acre MDA threshold to identify functional ecological reserves under each alternative. We then evaluated the degree to which the various ecological communities are represented in functional reserves.

Two areas of restricted management were not included in the ecological reserves concept: channel management corridors along streams, and Indiana bat primary range. While channel management corridors contribute to structural habitat diversity by providing strips of potential old growth within managed landscapes, they are too narrow and subject to edge effects to serve as ecological reserves by themselves. Within Indiana bat primary range, old forest and partial harvesting will be emphasized, which will make primary range less intensively managed than lands in the suitable timber base. However, active management could occur, focusing on habitat enhancement for Indiana bats. Such management will involve thinning and other treatments to achieve a semi-open canopy and an abundance of snags. The degree to which these management practices mimic natural disturbance and successional processes in the variety of forested communities where they might be applied is debatable. Therefore, channel management corridors and Indiana bat primary range were not considered to be part of the ecological reserves evaluated in this analysis. Because these two lightly managed categories of land were not included in the reserves concept, this analysis is considered to represent the minimum ecological reserve capacity of the Forest. Because channel management corridors and Indiana bat primary range do not vary by alternative, conducting the analysis in this conservative manner did not affect comparisons among alternatives.

The purpose of the MDA analysis was to provide a conceptual tool for evaluating the degree to which each alternative addresses landscape-scale ecological issues like forest fragmentation/patch size, old growth, and maintenance of natural disturbance and forest development processes. While Forest Plan direction does not explicitly provide for MDA reserves, they are an effect of MP allocation and Forest-wide direction to address other issues, and the Forest recognizes that the combined effect of such allocations and direction constitutes the primary mechanism for addressing the old growth, fragmentation, and patch size issues (see also 2006 Forest Plan, Appendix B).

The MDA indicator provides a rough index by alternative of the potential for development of large blocks of old forest that are shaped largely by natural processes. It is important to remember that the MDA reserves are generally surrounded by forested land that enhances their function beyond what would be achieved by similar-sized reserves in an agricultural or suburban landscape. In the early decades of the planning horizon, forest structure and function within the reserves will be similar to forest structure and function outside the reserves. Thus the full effect of the reserves will take at least several decades to emerge, as timber harvests maintain young and middle-aged forest characteristics outside the reserves, while old-growth dynamics develop inside the reserves.

Table ED-3. Estimates of MDAs for the Appalachians and Northeastern U.S.

MDA Acres	Rationale	Disturbance Size Citation
1,200	Twice a maximum wind disturbance size for southern Appalachians (Chattahoochee NF, Georgia)	Haney et al. 2000
1,750	50 times a low-end mean wind disturbance size for northeastern U.S.	Seymour et al. 2002
8,700	Twice a maximum fire disturbance size for central Appalachians (George Washington NF, Virginia)	Haney et al. 2000
11,500	50 times a high-end mean wind disturbance size for northeastern U.S.	Seymour et al. 2002
18,700	Twice a maximum wind disturbance for northeastern U.S.	Seymour et al. 2002
25,000	50 times a mean fire size for northeastern U.S.	Seymour et al. 2002

Ten areas on the Forest currently meet the 10,000-acre MDA threshold (Table ED-4). These areas range from about 11,000 acres to nearly 100,000 acres and are located in the northern, central, and southwestern parts of the Forest (See Map Package – Minimum Dynamic Area Reserves Alternative 1, which also represents the current condition). The total area contained in these reserves is approximately 310,000 acres. This total area comprises about 34 percent of all NFS land and about 18 percent of all land within the Forest boundary. The reserves are disproportionately located in the higher elevation areas of the Forest, and are largely dominated by northern hardwood forest, mixed mesophytic/cove forest, and spruce forest.

The proportion of each major forested community that is contained within the reserves varies greatly among the communities (Table ED-4). Ninety-five percent of spruce forest on NFS land is contained in the reserves. Seventy-one percent of northern hardwood forest on NFS land falls within the reserves, as does an estimated 56 percent of the hemlock forest. Reserves contain about 29 percent of the mixed mesophytic/cove forest on NFS land, but only 12 percent of the pine-oak forest and 9 percent of the oak forest. Based on these proportions, it would appear that spruce forest, northern hardwood forest, and hemlock forest are well represented in reserves. Mixed mesophytic and cove forest has somewhat less proportional representation in reserves, while pine-oak and oak have very little proportional representation in reserves.

However, the true measure of how well communities are conserved may not be the percentage of the current community total that is included in reserves. Rather, the amount of a community included in reserves expressed as a percentage of the presettlement amount of that community may be a better gauge of adequate representation. Based on applying this measure to all land ownership in the Forest boundary, only about 1 percent of the presettlement amount of hemlock forest is included in reserves, and the representation of spruce forest is 11 to 27 percent. In contrast, representation of northern hardwoods in reserves appears to be at least 93 percent of the estimated presettlement amount. Representation of mixed mesophytic/cove forest is about 15 percent, while representation of pine-oak forest and oak forest is 9 and 6 percent, respectively (Table ED-4). These percentages suggest that representation of hemlock forest and spruce forests in reserves is relatively low, even though reserves include a large proportion of the existing acreage of these communities on NFS land. Percentage representation of mixed mesophytic and cove forest is similar to spruce forest, but because mixed mesophytic and cove forest is such a widespread community, relatively low percentage representation probably is not a major conservation concern for this community.

Regardless of whether representation is measured against current or presettlement amounts, representation of oak and pine-oak forests in reserves appears to be low. However, because oak and the yellow pine-oak component of pine-oak communities are fire-adapted, including these communities in *de facto* reserves may not be the best way to conserve them. MPs 5.0 and 6.2, along with West Virginia northern flying squirrel habitat, comprise a large majority of the acreage in MDA reserves. Currently MPs 5.0 and 6.2 mandate suppression of wildfires, and MP 6.2 also prohibits use of prescribed fire. West Virginia northern flying squirrel habitat is not likely to include fire-adapted communities. Long-term conservation of oak and pine-oak communities requires more active management than is currently allowed in these MPs.

Table ED-4. Current Representation of Major Ecological Communities in MDA Reserves, Monongahela National Forest

Community	Acres	Percent of Current Amount on NFS Land	Percent of Estimated Presettlement Amount on All Ownerships Within Forest Boundary
Spruce forest	46,000	95	11 – 27
Mixed mesophytic/cove forest	110,000	29	14 – 16
Northern hardwood forest	120,000	71	≥93
Hemlock forest	2,000	56	1
Oak forest	22,000	9	6
Pine-oak forest	6,000	12	9
Other communities	9,000	27	?
Total[1]	310,000	34	18

[1]Due to rounding, the total does not equal the sum of the components.

ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Laws, Regulations, and Policies

Numerous laws, regulations, and policies govern the management of ecological communities on NFS lands. National laws and regulations have also been interpreted for implementation in the Forest Service Manual and Handbook. Some of the more influential laws, regulations, and policies governing management of ecological communities are listed in Table ED-5 below:

Table ED-5. Major Laws, Policies, and Regulations Influencing Management and Protection of Ecological Communities on National Forest System Land

Act/Law/Regulation/Policy	Law/CFR/FSM/FSH Number
Wilderness Act	16 U.S.C. 1131-1136
Eastern Wilderness Act	16 U.S.C. 1132
National Forest Management Act	16 U.S.C. 1600-1614
Clean Water Act	33 U.S.C. 1251 - 1376
Multiple Use-Sustained Yield Act	16 U.S.C. 528-531
National Forest Planning Regulations – diversity requirements	36 CFR 219.26, 36 CFR 219.27(g)
Healthy Forests Restoration Act	P.L. 108-148
Forest Service Manual, Ecosystem Classification, Interpretation, and Application	FSM 2060
Forest Service Manual, Wilderness Management	FSM 2320

Forest Plan Direction and Implementation

Forest Plan direction for the management and protection of ecosystem diversity occurs at two levels, Forest-wide and MP. Forest-wide goals, objectives, standards, and guidelines encourage or require the maintenance of a diversity of community types and forest ages, from young regeneration areas to old growth. Specific direction calls for the protection of rare communities. Revised Forest-wide direction that applies to the action alternatives has a stronger emphasis than 1986 Forest Plan direction on ecosystem diversity, restoration, and maintenance of representative examples of natural ecological communities. The revised Forest-wide direction includes a strategy to use MPs 5.0, 5.1, 6.2, 7.0, and portions of 8.0 as sources for core areas of potential old growth. The revised Forest-wide direction also includes goals and objectives to maintain and restore rare communities, fire-adapted communities, and representative examples of unmanaged natural habitats. Guidelines in the revised Forest-wide direction include stronger prohibitions on disturbance in wetlands and other rare communities.

Management Prescription (MP) direction also includes goals, objectives, standards, and guidelines encouraging maintenance of a diversity of community types and forest ages. Such direction is contained primarily in those MPs that are in the suitable timber base, where active management is a primary means of achieving age class diversity (MPs 2.0, 3.0, 4.0, 4.1, and 6.1). As with Forest-wide direction, the revised MP direction contains a stronger emphasis than the existing MP direction on ecological restoration. MP 4.1, which exists only in the three action alternatives, focuses on restoration of natural species composition and habitat structure in spruce and hardwood-spruce communities. The revised direction for the action alternatives also has a new emphasis on maintenance and restoration of oak forest and other fire-adapted communities in MP 6.1. The revised MP 6.2 for the action alternatives has a new secondary emphasis on restoration of natural communities, in addition to the primary emphasis on remote backcountry recreation. Also, in the action alternatives, the NRA has been allocated to a new MP (8.1) that contains a secondary emphasis on ecological restoration.

During Forest Plan implementation, planning for major management activities generally is conducted on a fifth- or sixth-order watershed basis. Project planning and analysis attempts to achieve the plant community age class composition expressed in the desired condition for the MPs contained in the watershed. Site-specific analysis is used to attain desired dispersion of community components and age classes across the landscape. Rare communities and other communities of interest are identified through project-level analysis, and mitigation measures are applied to protect or enhance these communities as needed.

Effects Common to All Alternatives

Mineral Exploration, Development, and Leasing

Amount and Development Stages of Major Forested Communities - Gas well sites, mine sites, and associated roads, pipelines, and facilities convert some major forested community acreage to non-forest habitat. These features also contribute to fragmentation of remaining forest habitat. After completion of mineral development activities, disturbed areas may recover to provide young forest habitat, and ultimately mature forest by the later decades of the planning horizon. The speed and degree of recovery would depend on the intensity of surface disturbance and the effectiveness of reclamation.

Natural gas leasing is the most common form of mineral development on the Forest. Effects of gas development on major forested communities usually are minor. Typically the maximum surface disturbance associated with each gas well is about 15.5 acres. This includes about 2 acres for the well site, 2 acres for access roads, and 11.5 acres of pipelines. Pipelines are approximately 15 to 40 feet wide, and monitoring on the Forest has shown that the tree canopy usually closes over the pipeline within 3 to 5 years. Thus, the long-term effects of each gas well amount to the conversion of an estimated 4 acres of forested habitat to non-forested habitat. The maximum density of gas wells in most areas is about one well per 640 acres. Therefore, the long-term effects to major forested communities are estimated to include the conversion of less than 1 percent of the forested habitat in a given area to non-forested habitat.

Development of other federal minerals currently is rare on the Forest, but it could occur in the future under any of the plan alternatives. Effects from development of minerals other than gas are difficult to predict because they vary depending on the mineral being developed, recovery methods (subsurface vs. surface mining), the intensity of surface disturbance, and the effectiveness of reclamation. However, any mineral development activity is likely to involve at least some long-term conversion of major forested communities to non-forest habitat.

Amount of Rare and Unique Communities - Federal mineral exploration, development, and leasing will avoid most rare and unique communities. Mineral activities could occur in pastures, grazing allotments, or wildlife openings that are classified with the high-elevation grasslands or woodlands, savannas, and grasslands communities. Such activities could result in small losses of these community types. Should mineral activities occur in areas that currently have a semi-primitive non-motorized ROS classification, remote habitat would be reduced by the amount of land that no longer meets the semi-primitive non-motorized criteria.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - Surface occupancy associated with federal mineral activity is prohibited in many of the areas that make up MDA reserves. These areas include the following:

- Congressionally designated Wilderness (MP 5.0)
- Recommended wilderness (MP 5.1)
- MP 6.2
- Remote backcountry portions of the NRA
- MP 8.0 scenic areas and botanical areas
- Key areas for Indiana bats

Surface occupancy is not specifically prohibited in eligible Wild and Scenic River corridors, but the requirement to maintain the potential Wild or Scenic classification makes surface occupancy very unlikely. Surface occupancy is not prohibited in the following areas that are part of MDA reserves:

- Certain areas with a very high scenic integrity objective
- Portions of the NRA that are not remote backcountry
- Potential spruce restoration areas within MP 4.1.
- West Virginia northern flying squirrel suitable habitat

The proportion of total MDA reserve acreage that is open to surface occupancy varies by alternative. Within areas where surface occupancy is possible, alteration to ecological communities would be as described above for major forested communities. Such minor surface disturbance would not measurably affect the proportional representation of communities in reserves, and is not expected to substantially impair the integrity and function of MDA reserves.

Vegetation/Timber Management – Mechanical Treatments

Amount and Development Stages of Major Forested Communities - For the purpose of evaluating ecological effects to major forested communities, mechanical vegetation treatments can be classified into three categories: even-aged regeneration harvesting, uneven-aged harvesting, and intermediate treatments such as thinning.

Even-aged regeneration harvesting is the major tool used to manipulate the age class distribution of the major forested communities. These types of harvest treatments change mature and old stands into young stands. Resetting forest development not only changes the structure of the community, it can also arrest natural changes in plant and animal species composition that occur as the community ages. Depending on the community types and the existing age class distribution in a given area, changing mature and old stands to young stands can contribute to or detract from the coarse-filter conservation goal of maintaining the natural forest development stage distribution on representative portions of the landscape.

Uneven-aged harvests do not convert mature and old stands to young stands. Depending on the community types and the existing age class distribution in the area considered, this lack of conversion can contribute to or detract from the coarse-filter conservation goal of maintaining the natural forest development stage distribution on representative portions of the landscape. Although uneven-aged harvests do not reset forest development, they do change community structure by creating canopy gaps that allow development of complex vertical layering of understory and midstory vegetation. Uneven-aged harvesting also allows increased growth rates in the unharvested trees, which can hasten the development of large trees. Uneven-aged harvesting creates or perpetuates multiple age classes of trees within a stand, and it favors the regeneration of shade-tolerant trees. Taken together, these changes create a stand that is structured similar to an old forest. Depending on existing community types and forest development stage distributions, such accelerated development of stands with old forest characteristics can contribute to or detract from maintenance of representative examples of natural community composition and forest development stages.

The effects of intermediate treatments on community structure are similar to the effects of uneven-aged harvesting. However, intermediate treatments generally are used as part of an even-aged management system, so the associated effects are temporally limited to the latter portion of a typical even-aged rotation. Effects associated with intermediate treatments may contribute to the development of community structure typical of old stands for a few decades of the rotation. Depending on existing community types and development stages, such old forest characteristics can contribute to or detract from maintenance of representative examples of natural community composition and development stages.

Amount of Rare and Unique Communities - Mechanical vegetation management will avoid most rare and unique communities. Management activities in areas adjacent to rare and unique communities could alter light regimes or microclimates enough to affect community structure or composition, but site-specific mitigation measures are expected to minimize such effects. Maintained openings that are classified as high-elevation grasslands or woodlands, savannas, and grasslands could be used as log landings. Such use would result in the temporary loss of that portion of the community. Vegetation damage and soil compaction from such use could alter the structure and composition of the community for several years to several decades following use.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - In the various land classifications that make up MDA reserves, mechanical vegetation treatments either are not allowed, are directed at enhancing the specific unique values of the land classification, or are intended to restore natural ecological communities. The proportion of land in these categories varies by alternative. Any vegetation treatments that occur are not expected to substantially impair the integrity and function of MDA reserves. To the extent that the treatments restore natural ecological community structure, they may improve the integrity and function of MDA reserves. Restoration treatments, particularly spruce restoration in MP 4.1, may change the proportional representation of communities in MDA reserves to the extent that the treatments cause changes in forest types. Any such change would likely involve an increase in the representation of spruce forest and a corresponding decrease in the representation of northern hardwood forest.

Vegetation/Timber Management – Salvage Harvest

Amount and Development Stages of Major Forested Communities - Salvage harvests remove dead or dying trees from sites that have been affected by a natural disturbance such as fire or wind. Salvage harvests do not change the existing forest development stage distribution; salvage areas have already been changed from mature or old forest to young forest by a natural disturbance. However, salvage harvests simplify community structure and remove organic material from the site. This removal of structure and organic material can change natural community recovery processes and, in general, it detracts from maintenance of representative examples of natural communities.

Amount of Rare and Unique Communities - Salvage harvesting would avoid most rare and unique communities. Salvage activities in areas adjacent to rare and unique communities could alter light regimes or microclimates enough to affect community structure or composition, but site-specific mitigation measures are expected to minimize such effects. Maintained openings that are classified as high-elevation grasslands or woodlands, savannas, and grasslands could be used as log landings. Such use would result in the temporary loss of that portion of the community. Vegetation damage and soil compaction from such use could alter the structure and composition of the community for several years to several decades following use.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - The intensity of salvage operations allowed in MDA reserves varies among the land categories that make up the reserves. A breakdown of the various levels of salvage allowed follows.

Removal of any commercial timber products, including through salvage, is prohibited:

- Designated Wilderness (MP 5.0)
- Some of the MP 8.0 scenic and botanical areas

Salvage is not explicitly addressed, but all management of overstory vegetation is limited to research or actions undertaken to maintain or improve TEP species habitat, effectively prohibiting large-scale salvage:

- West Virginia northern flying squirrel suitable habitat
- Indiana bat key areas

Salvage is not prohibited, but is limited to extensively damaged areas or cannot substantially alter the natural environment:

- Recommended Wilderness (MP 5.1)
- MP 6.2
- Eligible Wild and Scenic River corridors

Salvage is not restricted:

- Some MP 8.0 scenic areas
- The NRA
- MP 4.1 spruce restoration areas
- Certain areas with a very high scenic integrity objective

The proportion of MDA reserve area in these intensity categories varies among the alternatives.

Salvage logging occurs in areas where the overstory is already dead or dying. It will not cause a change in forest type; therefore it will not change the proportional representation of ecological communities in MDA reserves. However, salvage operations have the potential to remove large amounts of dead wood, thereby changing natural community structure, altering the effects of the natural disturbance regime, and altering natural recovery processes. In locations where salvage occurs, such effects have the potential to impair the function of MDA reserves, which is to allow communities to be shaped primarily by natural processes or management that restores natural structure and composition. The degree to which this function is impaired would depend on the intensity of the salvage operation (i.e., basal area removed) and the area of the salvage operation in relation to the total area of the affected MDA reserve. Typically, salvage occurs in small, localized areas and has little potential to affect landscape-scale functions of MDA reserves.

<u>Range Management – Livestock Grazing</u>

Amount and Development Stages of Major Forested Communities - Acreage devoted to range allotments has been declining slowly over several decades, and the revised Forest-wide management direction calls for maintenance of existing grazing capacity. Based on current trends and revised management direction emphasis, new allotments likely will be limited to newly acquired lands that contain pastures. Therefore, range management is not likely to convert any existing major forested communities to non-forest habitat. If the decline in range acreage continues, some range land will be replaced by forested habitat, initially in the young forest stage, but ultimately progressing to the mature stage in the later decades of the planning horizon.

Depending on the existing community composition and development stage distribution of the area under consideration, such reversion of land to young and mature forest could have positive or negative effects on the maintenance of representative natural community composition and development stage distributions.

Amount of Rare and Unique Communities - Range management is not expected to expand in the foreseeable future, so there is little opportunity for range management to cause new effects to rare and unique communities. Should grazing allotments be created or expanded, every effort would be made to avoid impacts to rare and unique communities. However, any such creation or expansion of range allotments would increase the amount of high-elevation grasslands or woodlands, savannas, and grasslands. Should the current downward trend in range acreage continue, the amount of these grassland communities would decrease. A reduction in range acreage could result in passive restoration or enhancement of other rare and unique communities (e.g., bogs or seeps that may be included in current allotments).

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - Range allotments are prohibited in designated Wilderness (MP 5.0), and new allotments are prohibited in recommended Wilderness (MP 5.1). In all other land classifications that make up MDA reserves, range management is allowed to varying degrees. Because range management is not expected to expand appreciably in the foreseeable future, the potential for new effects on MDA reserves is low. Maintenance of existing allotments within MDA reserves may prevent communities from being shaped primarily by natural processes or management that restores natural structure and composition. However, range management affects such a small total acreage Forest-wide (currently around 7,000 acres) that any effects on MDA reserves are expected to be minor.

<u>Fire Management – Fire Suppression</u>

Amount and Development Stages of Major Forested Communities - Fire suppression prevents intense wildfires from converting mature and old forests to young forests. Fire suppression also prevents low-intensity wildfires from consuming dead wood and killing understory vegetation, thereby encouraging the development of complex habitat structure and promoting shade-tolerant, fire-sensitive vegetation. The degree to which fire suppression contributes to or detracts from maintenance of representative natural communities and forest development stages depends on existing community composition, structure, and forest development stage distribution relative to the presettlement condition. Fire suppression in fire-adapted communities can have negative effects on the restoration and maintenance of natural community composition and structure. Long-term suppression in such communities can cause an unnatural buildup of fuels, which increases the potential for stand-replacing wildfires. In such situations, suppression in the short term can prevent community destruction by unnaturally intense fires that result from the long-term fuel buildup, but the benefit of such suppression is short-lived unless it is coupled with fuel reduction efforts to prevent future intense fires.

Amount of Rare and Unique Communities - Fire suppression typically is an emergency activity with the highest priority given to safety and prevention of property damage. Although efforts will be made to avoid damage to rare and unique communities, under some circumstances it may be necessary for fire lines and other disturbance associated with suppression activities to impact these communities. Any such damage would be rehabilitated to the extent possible.

Other effects of fire suppression on rare and unique communities depend on whether suppression occurs in a fire-adapted landscape. In fire-adapted areas, suppression may allow encroachment of woody vegetation in fire-maintained examples of high-elevation grasslands or woodlands, savannas, and grasslands. Such encroachment could degrade or eliminate these communities. In non-fire-adapted landscapes, fire suppression could protect fire-sensitive rare and unique communities (e.g., certain wetlands and wet rock outcrop communities) from wildfire effects.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - The effects of fire suppression on MDA reserves depend on whether suppression is occurring in a fire-adapted landscape. Suppression in fire-adapted communities impedes the operation of natural disturbance and recovery processes, thereby interfering with the function of MDA reserves. To the extent that fire suppression causes forest type changes, it can alter the proportional representation of communities in MDA reserves. Suppression in non-fire-adapted communities can prevent the destruction of fire-sensitive communities. Because most fires in such communities are human-caused, suppression in non-fire-adapted areas acts to protect the natural disturbance and recovery processes, thereby supporting the function of MDA reserves. To the extent that it prevents forest type changes due to catastrophic fire, suppression in these communities can maintain proportional representation of ecological communities in MDA reserves.

<u>Fire Management – Prescribed Fire Use</u>

Amount and Development Stages of Major Forested Communities - Prescribed fire generally involves low-intensity surface fires that consume dead wood and kill understory vegetation. Such fires simplify vertical habitat structure above the ground, but often encourage growth of herbaceous plants and low shrubs near the ground. In fire-adapted communities such as oak forests, such effects would contribute to the coarse-filter goal of maintaining representative examples of natural communities. In non-fire adapted communities such as spruce forests, prescribed fire would tend to create or perpetuate unnatural community composition and structure. It is possible for prescribed fires to escape and become more intense fires that kill overstory trees. Such fires would convert mature or old stands to young stands. Depending on the existing community types and forest development stage distribution, development stage conversion could contribute to or detract from maintenance of representative natural community composition and development stage distributions.

Amount of Rare and Unique Communities - Prescribed fire will avoid rare and unique communities, unless fire is necessary for community maintenance or enhancement. If a prescribed fire escapes control, it could damage fire-sensitive rare and unique communities if any are present in the area. Prescribed fire in fire-adapted landscapes could enhance or expand rare and unique communities.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - The effects of prescribed fire on MDA reserves depend on whether prescribed fire is used in a fire-adapted landscape. Prescribed fire in fire-adapted communities mimics natural disturbance and recovery processes, thereby enhancing the function of MDA reserves. To the extent that prescribed fire maintains forest types that would otherwise be lost to the effects of fire suppression, it can maintain the proportional representation of communities in MDA reserves. Prescribed fire in non-fire-adapted communities can alter or destroy fire-sensitive communities. In this context, prescribed fire changes the natural disturbance and recovery regime. If prescribed fire escapes control and damages the overstory, it can change forest types and alter the proportional representation of communities in MDA reserves.

Roads – Construction, Reconstruction, Maintenance, and Decommissioning

Amount and Development Stages of Major Forested Communities - Construction of new roads converts small amounts of major forested communities to non-forested habitat. New roads also create an edge effect, thereby fragmenting remaining forested habitat. Such fragmentation can change plant and animal species composition, typically in a manner that moves species composition further away from representative natural conditions. Reconstruction of existing roads has similar effects to the extent that the existing roads have been reclaimed by forested communities. These effects tend to have negative effects on the maintenance of representative natural community composition and structure, and result in a minor decrease in overall area covered by major forested communities. However, some disturbance-dependent forested communities (e.g., oak forest) require human-caused disturbance because of the loss of presettlement disturbance regimes. For these communities, access is essential for management that mimics the natural disturbance regimes. The level of road construction and reconstruction necessary to facilitate management access contributes to the maintenance of representative natural communities and forest development stages.

Road maintenance perpetuates the habitat changes that are created by road construction and reconstruction. Road maintenance prevents natural processes from reversing fragmentation and recovering lost forested area. In disturbance-dependent communities that are perpetuated by management-related disturbance, road maintenance ensures continued access to facilitate the necessary management.

Road decommissioning hastens natural recovery from the fragmentation and loss of forest associated with road construction and reconstruction. Decommissioning can also remove the access necessary for management in disturbance-dependent forested communities.

Amount of Rare and Unique Communities - Road construction and maintenance activities generally will avoid impacting rare and unique communities unless avoidance is not possible (e.g., an essential crossing of a stream channel or linear wetland). When avoidance is not possible, project-specific mitigation measures will minimize damage. Proper road maintenance could reduce or eliminate negative effects such as sedimentation of nearby wetlands. Road decommissioning could result in restoration of rare and unique communities in locations where existing roads were built across such communities. Road construction or reconstruction in areas that currently have a semi-primitive non-motorized ROS classification would cause a decrease in remote habitat area.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - The potential intensity of road construction, reconstruction, and maintenance varies among the categories of land that are included in MDA reserves. A breakdown of the various levels of intensity follows.

Generally no road construction, reconstruction, or maintenance allowed:

- Designated Wilderness (MP 5.0)

Maintenance of existing roads allowed, but generally no new construction:

- Recommended Wilderness (MP 5.1)
- MP 6.2
- Some MP 8.0 scenic areas
- Indiana bat key areas

Maintenance of existing roads allowed; new construction not prohibited, but likely to be minor to nonexistent because of potential conflict with primary management emphasis:

- Most MP 8.0 scenic and botanical areas
- Remote backcountry portions of the NRA
- Eligible Wild and Scenic River corridors
- Certain areas with a very high scenic integrity objective
- West Virginia northern flying squirrel suitable habitat

System road density limited to 2½ miles per square mile:

- MP 4.1 spruce restoration areas

No major limitations:

- Portions of the NRA outside of remote backcountry

The allocation of MDA reserve acreage among these land categories varies by alternative.

The loss of forested area caused by road construction and reconstruction reduces the proportional representation of the affected ecological communities in MDA reserves. However, roads typically occupy a small fraction of the landscape, so substantial changes in proportional representation are not expected. For example, in MP 4.1 the maximum system road density of 2½ miles per square mile would result in roads occupying less than 2 percent of the landscape, assuming an average roadbed width of 33 feet.

The fragmentation effect of roads can alter natural ecological processes, which affects the function of MDA reserves. The fragmentation effect would be greatest immediately after road construction, and would decline as adjacent tree canopies grow and partially cover the road opening. Road maintenance prevents natural recovery processes from reversing the effects of past road construction.

Recreation – Developed Recreation

Amount and Development Stages of Major Forested Communities - Depending on the intensity of developed recreation activities, the associated facilities can have effects ranging from minor alteration of forested community structure (e.g., a small picnic area) to replacement of the forested community with structures and non-forested habitat (e.g., a visitor's center). Such facilities generally have a negative effect on the maintenance of representative examples of natural community composition and forest development stages, although the effects at the low end of the intensity scale are so minor that they can be considered negligible. Viewed in aggregate at the Forest-wide scale, the effect of new and existing developed recreation facilities on the total amounts of the major forested communities is likely to be very small.

Amount of Rare and Unique Communities - New developed recreation sites will avoid substantial impacts to rare and unique communities. Minor impacts could result if recreational access is provided to allow visitors to enjoy unique community attributes (e.g., a boardwalk through a bog). Where existing developed sites occupy or are adjacent to rare and unique communities, any increase in recreational use could intensify existing effects or cause new effects (e.g., trampling). Any construction of developed recreation facilities in areas that currently have a semi-primitive non-motorized ROS classification would cause a decrease in remote habitat area.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - The type of developed recreation facilities allowed or expected in MDA reserves varies among the land classifications included in the reserves. Following is a breakdown of the expected level of developed facilities.

No facilities allowed or only those necessary for resource protection:

- Designated Wilderness (MP 5.0)
- Recommended Wilderness (MP 5.1)
- Eligible Wild and Scenic River corridors
- Indiana bat key areas

Generally only small, low impact facilities expected:

- MP 6.2
- Remote backcountry portions of the NRA
- Some 8.0 scenic and botanical areas
- West Virginia northern flying squirrel habitat

Expected facilities are consistent with maintenance of high scenic quality:

- Certain areas with a very high scenic integrity objective
- Some 8.0 scenic areas

Facilities allowed that are consistent with the desired ROS zone, could include high-impact developed facilities in some areas:

- Portions of the NRA outside of remote backcountry

No major limitations on facilities:
- MP 4.1 spruce restoration areas

The proportional breakdown of MDA reserve acreage among these land categories varies by alternative.

Low impact facilities (e.g., boardwalks, signs, small picnic sites) occupy such small amounts of land that their effects on representation of ecological communities in MDA reserves will be negligible. Other effects from such facilities, such as fragmentation and interference with natural disturbance and successional processes, are also expected to be negligible.

Higher impact facilities (e.g., large picnic areas, campgrounds, visitor centers) that have more intense site-specific effects can alter or remove ecological communities, fragment communities, and interfere with natural disturbance and successional processes. However, on a Forest-wide basis, developed recreation sites are expected to occupy a very small total area. Therefore, to the extent such developed sites occur in MDA reserves, their effects on overall community representation and function in MDA reserves are expected to be very minor.

Recreation – Dispersed Recreation

Amount and Development Stages of Major Forested Communities - Trails associated with dispersed recreation generally have a very minor effect on major forested communities. These effects typically are limited to the absence of understory and midstory vegetation along the treadway. Dispersed-use trails generally do not involve removal of the tree canopy and therefore do not contribute to forest fragmentation at the stand scale or higher.

Other impacts of dispersed use could include construction of small facilities such as footbridges and pit toilets, trampling outside of trail treadways, and trampling or removal of vegetation and dead wood in and around dispersed campsites. All of these impacts tend to remove or simplify habitat structure and alter natural vegetation development processes. These impacts tend to have a negative effect on the maintenance of natural community composition and forest development stages. In most cases the effects are so minor that they could be considered negligible, although more substantial effects could occur in localized high-use areas.

Amount of Rare and Unique Communities - New trails and other facilities associated with dispersed recreation will avoid rare and unique communities unless avoidance is not possible. Where avoidance is not possible, such as a footbridge across a stream channel, site-specific mitigation measures will minimize negative impacts. Where trails or other dispersed recreation sites lie adjacent to rare and unique communities, increases in recreational use could result in new impacts to those communities (e.g., trampling, unauthorized plant collection).

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - Dispersed recreation involves such low-intensity alteration to ecological communities that it would not have a measurable impact on the representation or function of ecological communities in MDA reserves.

Recreation – Motorized Recreation Use

Amount and Development Stages of Major Forested Communities - Effects associated with motorized recreation are largely due to the roads that are necessary to facilitate motorized access. These effects are discussed above in the roads subsection. Because roads are rarely constructed solely for motorized recreational use, motorized recreation is likely to occur on roads that would have been constructed anyway for management access reasons. Therefore, effects of roads used for motorized recreation would not be additive to the road effects already discussed.

However, off-road motorized use could have additional effects on major forested communities. The Forest does not allow off-road motorized vehicle use except on designated routes. Currently there are no designated routes; so authorized off-road motorized recreation would require construction of a dedicated trail system to accommodate off-road vehicles. The effects of constructing and maintaining such a system would be similar to the effects of road construction and maintenance, but the effects would be in addition to the effects of roads that are constructed for management access. However, per mile of trail, fragmentation and forest loss effects would be less than road construction effects because off-road vehicles generally do not require trails as wide as most roads. Although no plan alternative contains specific goals, objectives, or limitations regarding the amount of off-road vehicle trails to be constructed, it is considered unlikely that the Forest would construct enough off-road vehicle trails to measurably affect the amount and development stages of major forested communities.

Amount of Rare and Unique Communities - Most effects to rare and unique communities due to on-road motorized recreation are covered above in the roads subsection. However, heavy on-road motorized recreation use could impair the ability of road maintenance to prevent sedimentation of nearby wetlands and stream channels.

Off-road motorized recreational sites generally would avoid rare and unique communities. Any unavoidable impacts, such as essential crossings of stream channels or linear wetlands, would be mitigated to minimize negative effects. Off-road motorized recreation sites could impact nearby wetlands and stream channels through sedimentation. However, every effort would be made to design off-road motorized trails such that off-site impacts to rare and unique communities are avoided or mitigated.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - Potential effects of on-road motorized recreation on MDA reserves are covered above in the roads subsection. Off-road motorized recreation would require construction of a new trail system. These effects would also be similar to the effects discussed above under roads, but would be in addition to those effects. However, per mile of trail, the magnitude of such effects would be less than effects associated with road construction due to the narrower width of off-road vehicle trails. Although no plan alternative contains specific goals, objectives, or limitations regarding the amount of off-road vehicle trails to be constructed, it is considered unlikely that the Forest would construct enough off-road vehicle trails to measurably affect community representation in MDA reserves.

Soil, Water, Riparian, Aquatic – Active Restoration

Amount and Development Stages of Major Forested Communities - Active soil, water, riparian, and aquatic restoration tends to focus on localized areas. Such localized activity has little or no potential for appreciable effects on the amount and development stage distribution of major forested communities. Revegetation for sediment and erosion control could eventually lead to reforestation of currently non-forested areas, resulting in minor increases in the amount of certain major forested communities.

Amount of Rare and Unique Communities - Active soil, water, riparian, and aquatic restoration is likely to result in improved condition or increased amounts of rare and unique communities with an aquatic component, such as stream channels and wetlands. If such restoration involves revegetation of non-forested areas, it could cause a decrease in the area of high-elevation grasslands or woodlands, savannas, and grasslands. Positive and negative impacts to rare and unique communities are not expected to affect large areas, but given that these communities generally occupy a small fraction of the landscape, such small effects may or may not be considered minor.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - Active soil, water, riparian, and aquatic restoration is generally allowed in most land classifications that are part of MDA reserves, although in many areas such restoration must blend with the natural environment and/or be consistent with ROS and SMS objectives. Localized active soil, water, riparian, and aquatic restoration affects such small areas that it has little or no potential for noticeable Forest-wide effects on the representation of ecological communities in MDA reserves. Such restoration may promote noticeable improvements in natural processes and functions in localized areas within MDA reserves, but at the Forest-wide level such effects are likely to be negligible.

Soil, Water, Riparian, Aquatic – Passive Restoration

Amount and Development Stages of Major Forested Communities - Passive soil, water, riparian, and aquatic restoration tends to be applied across broader areas than active restoration. Passive restoration that involves reforestation of currently non-forested areas has the potential to increase the amount of certain major forested communities. However, given that very little area currently is non-forested, any such effects are expected to be minor.

Amount of Rare and Unique Communities - Effects of passive soil, water, riparian, and aquatic restoration on rare and unique communities will be similar to those discussed above for active restoration.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - Effects of passive soil, water, riparian, and aquatic restoration on representation of ecological communities in MDA reserves will be similar to those discussed above for active restoration. Such effects could occur on a broader scale than that expected for active restoration. However, the area covered by restoration activities still is not likely to be large enough to create substantial effects.

Wildlife/Fish Habitat Restoration

Amount and Development Stages of Major Forested Communities - The potential effects of wildlife and fish habitat restoration on major forested communities vary widely depending on the wildlife species of management interest. Traditional maintained wildlife openings convert major forested communities to non-forest habitat and contribute to fragmentation of remaining forested habitat. These activities constitute a small negative effect on the maintenance of representative examples of natural community structure and forest development stage distributions. The desired condition for maintained openings does not exceed 8 percent in any MP, and those MPs outside the suitable timber base have no goals for maintained openings. Therefore, the Forest-wide effects of maintained openings on major forested communities, while not negligible, are not likely to affect a large proportion of the major forested communities under any alternative.

Habitat restoration activities for species characteristic of forested environments could increase the amount of certain major forested communities, and could contribute to the maintenance of natural forest development stage distributions. However, such habitat restoration typically is conducted on a small scale and any effects are likely to be minor.

Amount of Rare and Unique Communities - Wildlife and fish habitat restoration generally will avoid any negative impacts to rare and unique communities. If the species of management interest occurs in a rare or unique community, restoration likely will cause improved condition or increased amount of that community. Generally such effects will be limited to small areas, but because most rare and unique communities cover a small fraction of the landscape, the effects may or may not be considered minor.

Creation of new maintained wildlife openings will increase the area of high-elevation grasslands and woodlands, savannas, and grasslands. Total acreage is likely to be small in the context of the entire Forest, but relative to existing acreage of these communities, increases may or may not be considered minor.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth - The land classifications that make up MDA reserves generally allow fish habitat restoration, as long as it blends with the natural environment and/or is consistent with ROS and SMS objectives. Wildlife openings are allowed in MP 4.1 spruce restoration areas and the NRA. New wildlife openings are expected to be rare to nonexistent in the other land classifications due to prohibitions or conflict with the primary management emphasis. Restoration of forested habitat is generally allowed throughout the MDA reserves, except in the Cranberry Glades Botanical Area. Management techniques for habitat restoration are severely restricted in designated and recommended Wilderness (MPs 5.0 and 5.1, respectively).

Where traditional wildlife openings are allowed, they can subtract a small amount of area from ecological communities represented in MDA reserves. Fragmentation associated with openings may interfere with natural disturbance and successional processes. However, desired conditions for maintained openings where they are allowed do not exceed 5 percent, so the effects are expected to be minor. Habitat restoration activities in forested habitats will not change community representation in MDA reserves unless the activities cause a forest type change. Even in such a case, habitat restoration activities are not expected to affect large areas of the landscape, so effects to community representation in MDA reserves are expected to be minor. Wildlife habitat restoration in forested areas could enhance natural structure and function of communities in MDA reserves. Fish habitat restoration would affect such small areas of communities in MDA reserves that the effects are expected to be negligible.

Direct and Indirect Effects by Alternative

The discussion of direct and indirect effects by alternative focuses on NFS land. The Cumulative Effects section discusses the combined effects of activities on NFS land and activities on other land ownerships within the Forest boundary.

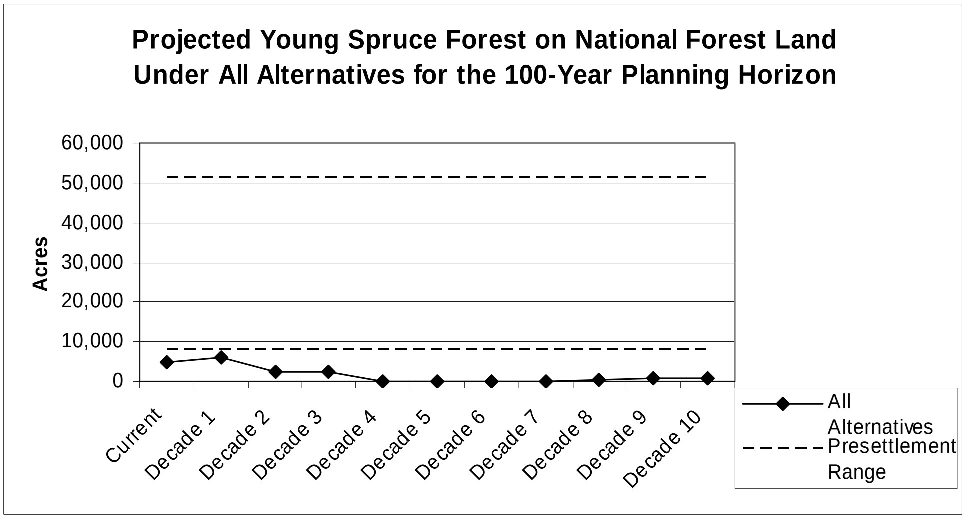
Amount and Development Stages of Major Forested Communities

Spruce Forest - Because forest type changes were not modeled in Spectrum, the projected total amount of each of the major forested communities under all alternatives remains the same as the current amount. In reality, for the action alternatives, spruce restoration efforts and continued natural succession are likely to cause the total amount of spruce forest to increase somewhat at the expense of northern hardwoods. The likelihood of spruce forest approaching presettlement amounts due to restoration and succession is difficult to assess, but land allocations suggest there are likely to be differences in active restoration among the alternatives. Restoration activities are likely to increase spruce forest the most under Alternative 4, which allocates the most northern hardwood areas to MP 4.1. Thus, in the early and middle decades of the planning horizon, Alternative 4 would move the total amount of spruce closer to the presettlement range than the other alternatives. Alternative 1 allocates no land to MP 4.1 and is likely to result in the least amount of active spruce restoration and, therefore, the greatest deviation from the presettlement range. Among the action alternatives, Alternative 3 allocates the least amount of northern hardwoods to MP 4.1 and is likely to result in low levels of active spruce restoration, while Alternatives 2 and 2M would restore less spruce than Alternative 4, but more than Alternative 3. Based on the amount of northern hardwoods in MP 4.1 and the various passive management areas, the combined amount of active and passive restoration would be similar under all of the alternatives. Therefore, toward the end of the planning horizon as natural succession proceeds, the total amount of spruce restoration likely would be similar under all alternatives.

Because essentially all spruce forest is considered suitable habitat for the West Virginia northern flying squirrel, extensive even-aged timber harvest is not expected to occur in spruce forest under any alternative. Therefore, the aging of existing stands will be the primary factor determining future amounts of spruce forest development stages under all alternatives.

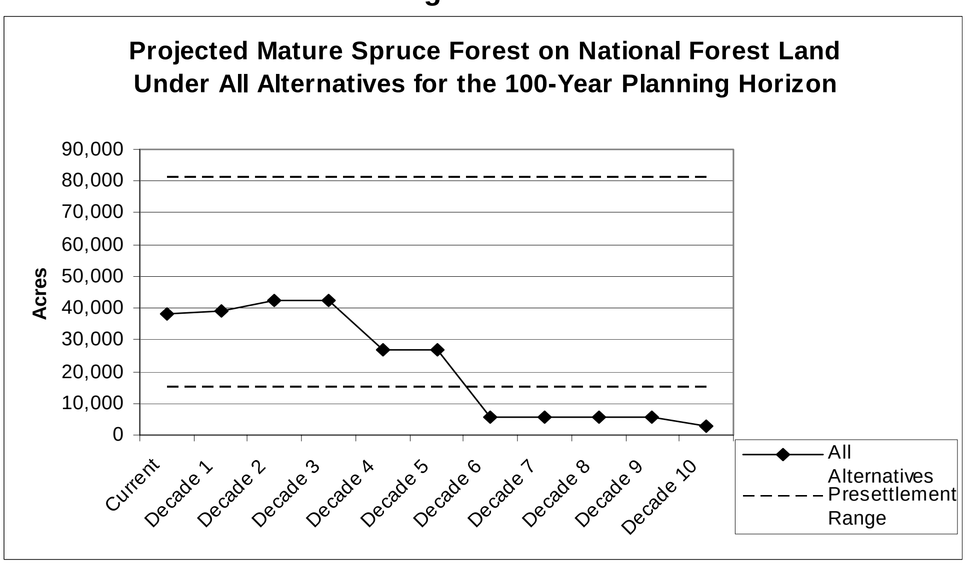
As current stands age, young spruce forest is projected to decline from its current low levels to approximately zero by the fourth decade of the planning horizon (Figure ED-7). This decline would keep the amount of young spruce forest below the estimated presettlement range. However, this projection does not account for the possibility that natural disturbances could create small amounts of early successional spruce forest.

Figure ED-7.



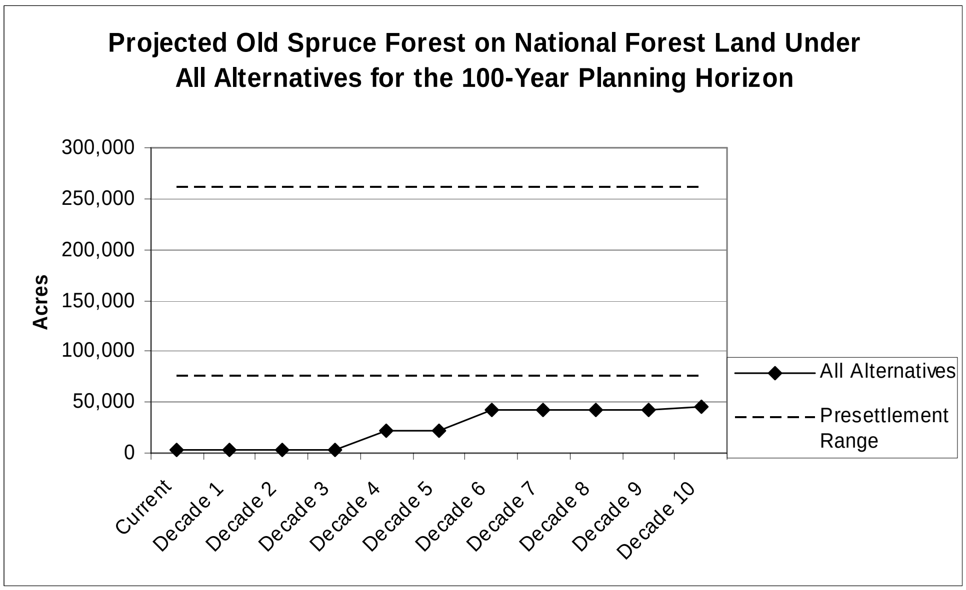
As current mature stands reach the old stage, mature spruce forest also is expected to decline, reaching approximately 6,000 acres by the sixth decade and less than 3,000 acres by the end of the planning horizon (Figure ED-8). This decline would reduce the amount of mature spruce forest below the estimated presettlement range. Again, this projection does not account for the effects of natural disturbances, which could reset forest development in some areas and maintain higher than the projected amounts of mature spruce forest. Also, it does not account for the potential restoration of mature northern hardwoods to mature spruce forest, which could keep the amount of mature spruce forest within the presettlement range. Because of different allocations to MP 4.1, such a scenario would be most likely to occur under Alternative 4 and least likely under Alternative 1.

Figure ED-8.



Old spruce forest is projected to increase from the current very small amount to about 42,000 to 45,000 acres in the sixth through the tenth decades of the planning horizon (Figure ED-9). This projected amount is still below the estimated presettlement range, but it is based only on aging of existing stands and does not account for potential increases due to spruce restoration. Because of differences in the amount of land allocated to MP 4.1, active spruce restoration would be most likely to move spruce toward its presettlement range under Alternative 4, and least likely under Alternative 1.

Figure ED-9.

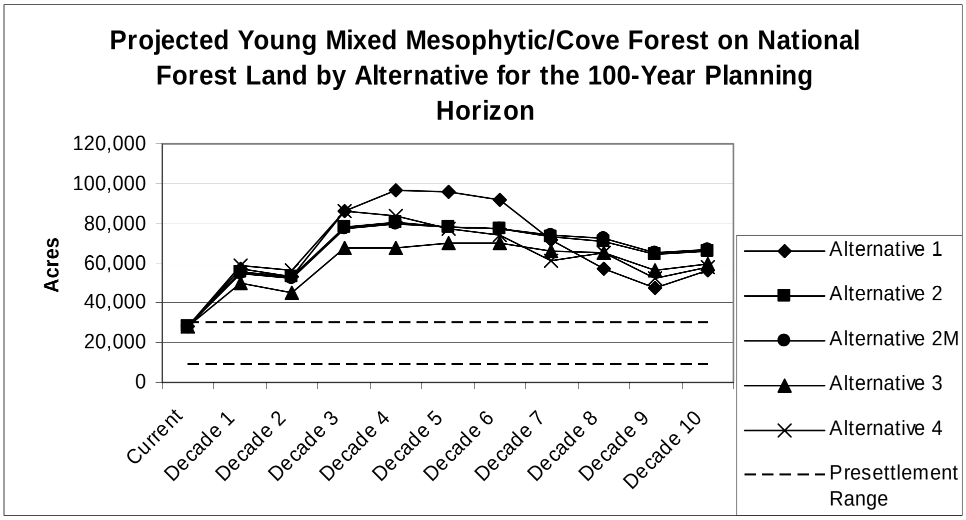


Mixed Mesophytic and Cove Forest – Future amounts of the forest development stages for this community are determined by two factors. Continued aging of existing stands drives an overall trend toward increasing amounts of the old stage and decreasing amounts of the mature stage, while timber harvesting drives a smaller trend toward increasing amounts of the young stage. For all three development stages, the general pattern through time is the same for all alternatives. However, the amounts do differ noticeably across alternatives for some decades in the planning horizon.

Young mixed mesophytic and cove forest, which currently is within the estimated presettlement range, is projected to increase to levels well above the presettlement range as timber harvesting to achieve age class diversity takes place during the first half of the planning horizon (Figure ED-10). Differences among alternatives are directly related to differences in the amount of even-aged timber harvesting. Alternative 1 produces the most, with the total amount reaching nearly 100,000 acres in the fourth and fifth decades of the planning horizon. Alternative 3 produces the least young mixed mesophytic and cove forest during this time, reaching about 70,000 acres during the fifth and sixth decades of the planning horizon. Alternative 4 produces the second highest amount of young mixed mesophytic and cove forest during the middle of the planning horizon, peaking at approximately 86,000 acres in the third decade. Alternatives 2 and

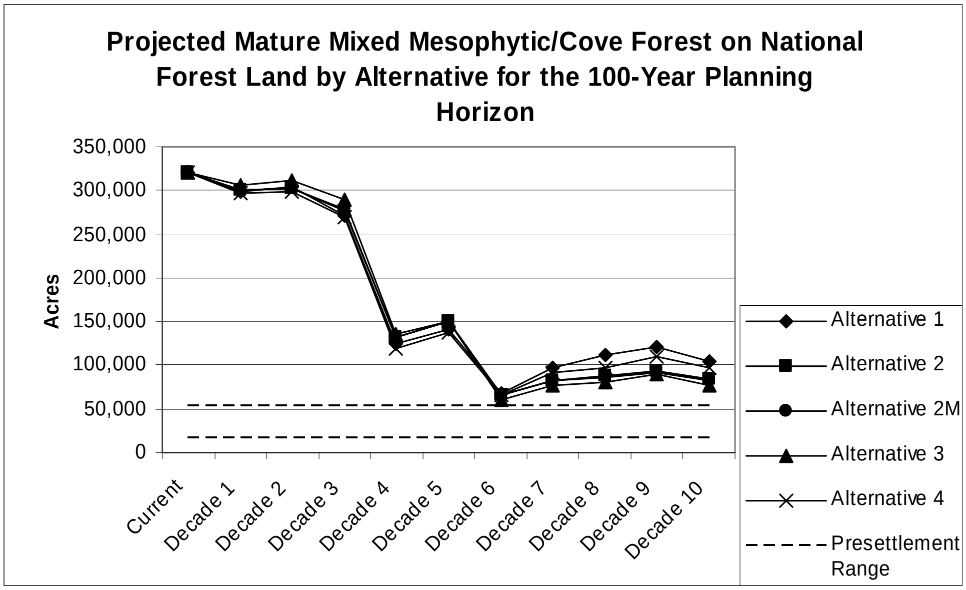
2M peak just above 80,000 acres in the fourth decade. Under all alternatives, the amount of young mixed mesophytic and cove forest is projected to decline during the later decades of the planning horizon, although in all alternatives the amounts remain well above the estimated presettlement range. The amount declines the most under Alternative 1, which reaches a low point of about 48,000 acres in the ninth decade. Alternatives 2 and 2M show the smallest decline, reaching a low point of about 65,000 acres in the ninth and tenth decades. Alternatives 3 and 4 have intermediate amounts, each providing a little less than 60,000 acres in the ninth and tenth decades.

Figure ED-10.



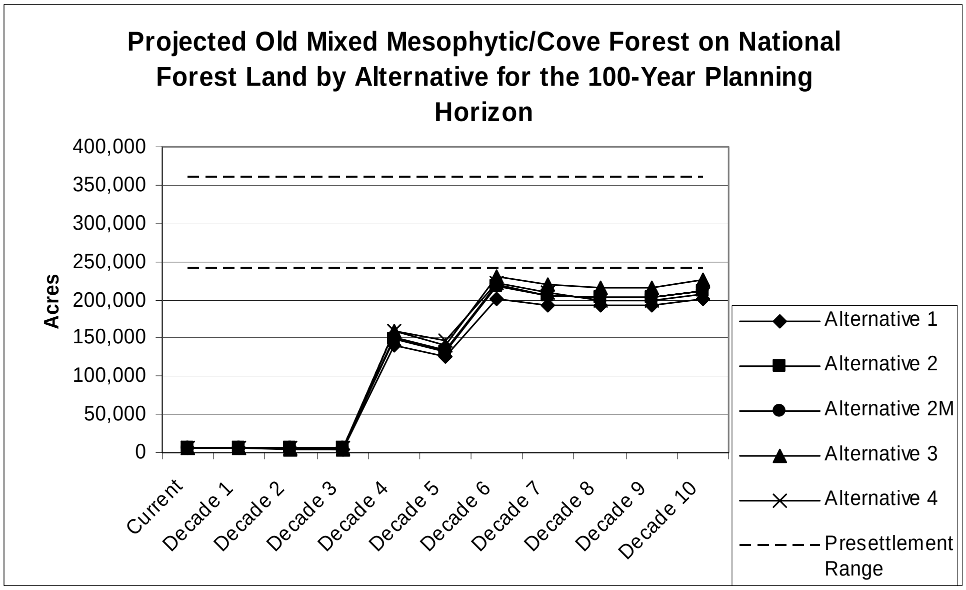
Under all alternatives, the amount of mature mixed mesophytic and cove forest is projected to follow a similar pattern throughout the planning horizon. This development stage is projected to decline only slightly from the current high level during the early decades of the planning horizon (Figure ED-11). The amount is projected to remain near 300,000 acres through the second decade of the planning horizon, and decline to about 270,000 to 290,000 acres in the third decade. These small declines reflect timber harvesting to achieve age class diversity. In contrast, the amount of mature mixed mesophytic and cove forest is projected to decline sharply under all alternatives during the middle decades of the planning horizon, reaching 60,000 to 70,000 acres in the sixth decade. However, the amount stays above the estimated presettlement range. This steep decline is caused by aging of mature stands into the old stage. After the sixth decade, the amount of mature mixed mesophytic and cove forest is projected to increase under all alternatives as stands harvested during the early decades of the planning horizon reach the mature stage. This increase is largest under Alternatives 1 and 4, which would harvest the most timber in the early decades. Under these alternatives, the amount reaches approximately 110,000 to 120,000 acres in the ninth decade. The increase is somewhat smaller under Alternatives 2, 2M, and 3, reaching about 90,000 acres in the ninth decade. Although the amount remains above the presettlement range for all alternatives, the amount under Alternative 3 is a little closer to the presettlement range than under the other alternatives during the sixth through tenth decades.

Figure ED-11.



Old mixed mesophytic and cove forest also is projected to follow a very similar pattern under all alternatives. For the first three decades of the planning horizon, the amount of old mixed mesophytic and cove forest is projected to remain at or below the current 6,000 acres under all alternatives (Figure ED-12). As currently mature stands reach 120 years of age during the fourth through sixth decades, the amount of old mixed mesophytic and cove forest increases dramatically under all alternatives, and remains near this higher level through the rest of the planning horizon. Some variation among alternatives is projected for the sixth through tenth decades. Alternative 3 is projected to maintain the highest amount at about 215,000 to 230,000 acres in the sixth through tenth decades, whereas Alternative 1 is projected to maintain the lowest amount at about 190,000 to 200,000 acres. Alternatives 2, 2M, and 4 are each projected to maintain approximately 200,000 to 220,000 acres during the sixth through tenth decades. These differences among alternatives are due to differences in the amount of timber harvest. Timber harvest reduces the amount of old mixed mesophytic and cove forest, both directly by harvesting old stands, and indirectly by harvesting mature stands before they can reach the old stage. During the sixth through tenth decades under all alternatives, the amount of old mixed mesophytic and cove forest approaches, but does not reach, the estimated presettlement range. Due to lower levels of timber harvest, Alternative 3 comes closest to reaching the presettlement range.

Figure ED-12.



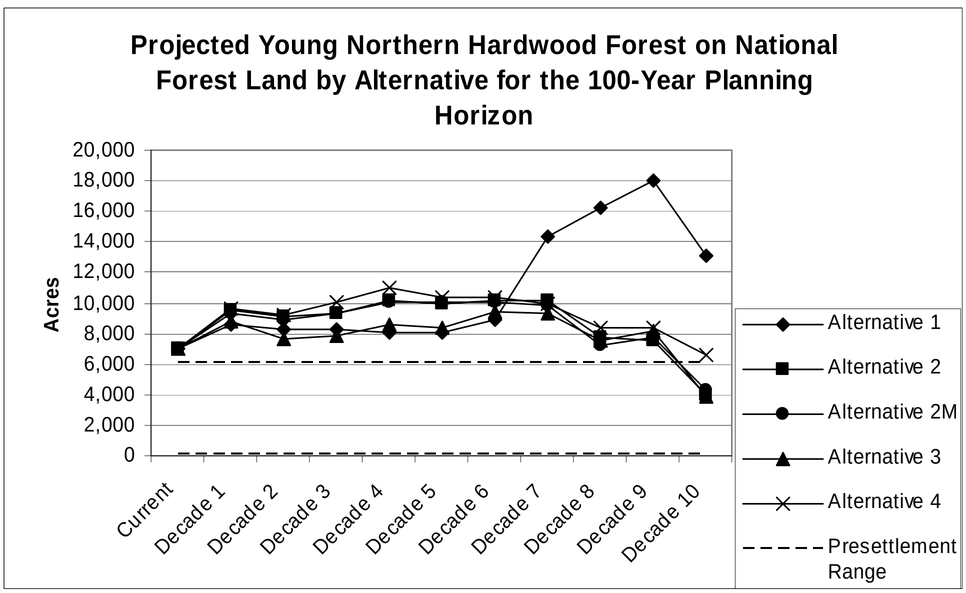
Northern Hardwood Forest – For northern hardwoods, the projected patterns through time in the amounts of the forest development stages are similar to the patterns for mixed mesophytic and cove forest. However, because a smaller proportion of the northern hardwoods community is in the suitable timber base, the patterns in this community are more strongly driven by aging of existing stands and show less effect from timber harvesting, especially under the action alternatives. As with spruce forest, the quantitative projections for this community do not account for the effects of potential spruce restoration. Therefore, the projected amounts may be overestimates, particularly for the mature and old development stages, which are likely to be reduced somewhat by passive and active spruce restoration.

For all alternatives, the amount of young northern hardwood forest is projected to increase somewhat in the early decades of the planning horizon due to even-aged timber harvesting in the portion of northern hardwoods that is in the suitable timber base (Figure ED-13). The increase would be greatest under Alternatives 2, 2M, and 4, which have the largest amount of northern hardwoods in the suitable timber base. Under these alternatives, young northern hardwood forest is projected to reach a little more than 10,000 acres in the fourth through sixth decades. Alternatives 1 and 3 produce slightly less of this development stage, with projected amounts of about 8,000 to 9,000 acres during the fourth through sixth decades.

During the seventh through tenth decades, the projected amount of young northern hardwoods for Alternative 1 is projected to diverge from the amount projected for the other alternatives. Under this alternative, young northern hardwood forest is projected to increase to about 18,000 acres by the ninth decade, and decline to about 13,000 acres in the tenth decade. In contrast, the other alternatives all show an accelerating decline in young northern hardwoods during the seventh through tenth decades. Under Alternatives 2, 2M, and 3, the amount is projected to decline to about 4,000 acres in the tenth decade, while for Alternative 4 the amount declines to about 7,000 acres in the tenth decade. The difference in projected young northern hardwoods under Alternative 1 versus the other alternatives is due to the absence of MP 4.1 in Alternative 1. Under the action alternatives, northern hardwoods in MP 4.1 were presumed to represent potential spruce restoration areas, so the model did not project any even-aged harvesting that would create young northern hardwoods in that MP. Modeling for Alternative 1 had no such assumption, so the model projected even-aged harvesting that caused an increase in the projected amount of young northern hardwoods.

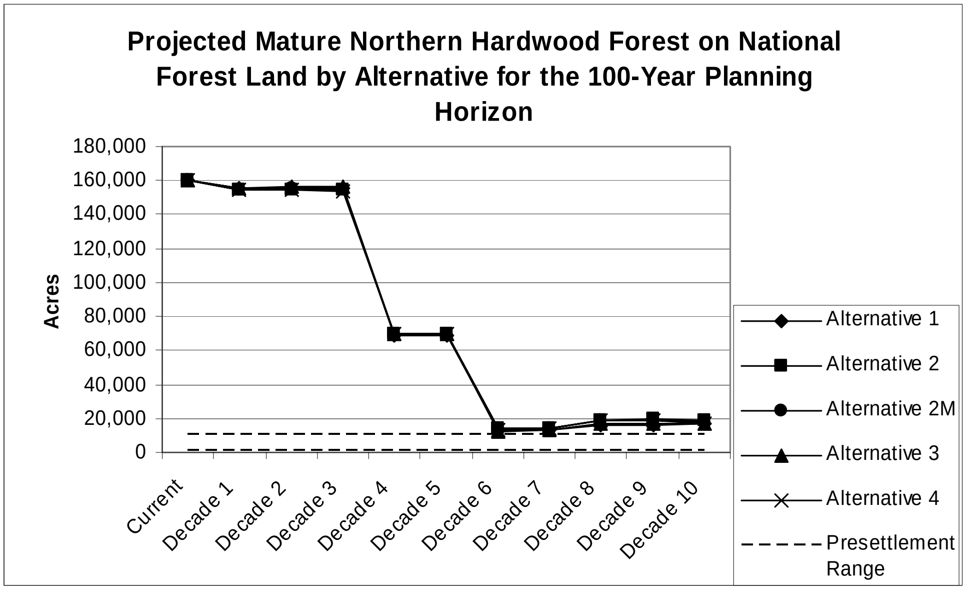
For all alternatives, the amount of young northern hardwoods is projected to remain above the estimated presettlement range for most of the planning horizon. For Alternatives 2, 2M, and 3 the amount is projected to fall within the estimated presettlement range during the last decade. Under Alternative 4 the amount remains slightly above the presettlement range at the end of the planning horizon, while the amount under Alternative 1 rises much farther above the presettlement range during the later decades of the planning horizon.

Figure ED-13.



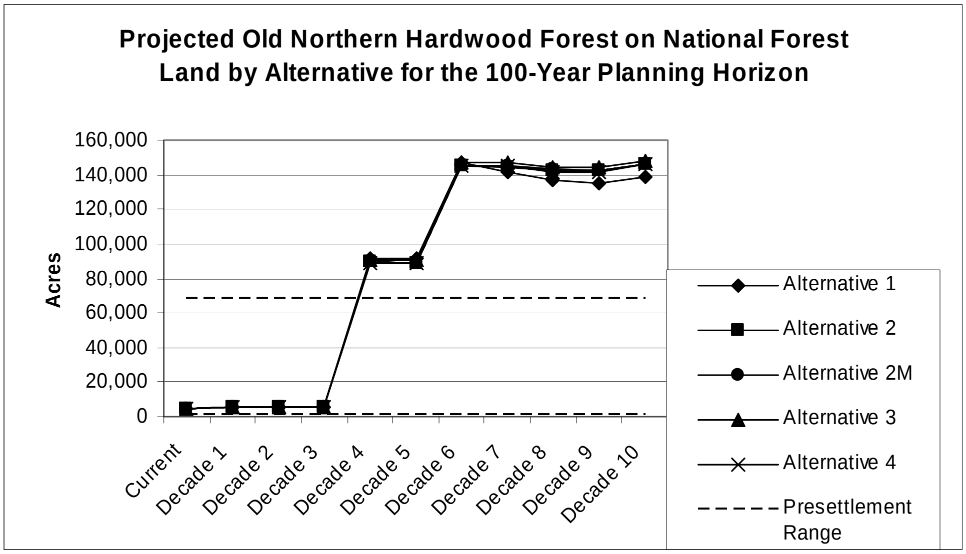
The projected pattern for mature northern hardwoods is strongly driven by aging of current mature stands and is nearly identical across all alternatives (Figure ED-14). For the first three decades of the planning horizon, the amount of mature northern hardwoods is projected to remain near the current 160,000 acres. In the fourth through sixth decades, the amount drops sharply as current mature stands shift to the old stage. For all alternatives, mature northern hardwoods are projected to reach a low point of about 13,000 to 14,000 acres in the sixth and seventh decades. The amount is projected to increase only slightly too about 17,000 to 19,000 acres in the eighth through tenth decades as the small fraction of northern hardwoods projected to be harvested in the early decades of the planning horizon reaches the mature stage. For decades six through ten, the amount projected for each of the alternatives is just above the upper end of the estimated presettlement range. Amounts projected for Alternative 1 are not noticeably different from amounts projected for the other alternatives because the higher harvesting levels under Alternative 1 are not projected to occur until the later decades of the planning horizon. Areas harvested in the last four decades do not reach the mature stage by the end of the planning horizon.

Figure ED-14.



The projected pattern for old northern hardwoods also is strongly driven by aging of current mature stands and is similar for all alternatives. However, for the later decades of the planning horizon, small differences emerge between amounts for Alternative 1 and amounts for the other alternatives (Figure ED-15). Through the third decade, the amount of old northern hardwoods is projected to remain near the current 5,000 acres. During the fourth through sixth decades, old northern hardwood forest is projected to increase to around 150,000 acres, taking this community well beyond the upper boundary of the estimated presettlement range. For Alternatives 2, 2M, 3, and 4, the amount of old northern hardwoods is projected to remain around 145,000 acres through the end of the planning horizon. For Alternative 1, the projected amount remains much higher than amounts for the early decades, but declines slightly too about 135,000 acres during the ninth decade. This slight decline is due to higher projected timber harvest amounts in northern hardwoods under Alternative 1.

Figure ED-15.



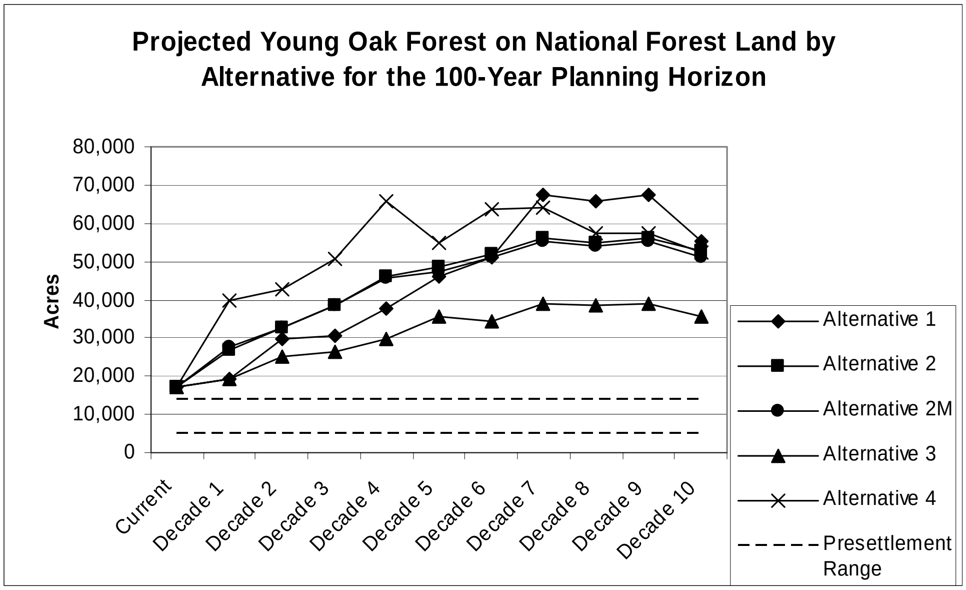
Hemlock Forest – This forested community was not modeled separately, so there are no quantitative projections for future amounts of hemlock forest development stages. Currently this community is estimated to cover only approximately 3,000 acres, almost all of which is in the mature stage. Because of the rarity of hemlock forest and the likelihood that much of it is included in suitable habitat for the West Virginia northern flying squirrel or channel management corridors, it is unlikely that appreciable amounts of even-aged harvesting will occur in this community. Therefore, the pattern of development stages through time is expected to trend heavily toward old forest under all alternatives, especially during the second half of the planning horizon. Although ecological restoration efforts could benefit hemlock in the very short term, by the later decades of the planning horizon it is likely that hemlock forest will have been greatly reduced or eliminated by the hemlock wooly adelgid (*Adelges tsugae*). Due to this exotic insect, prospects for long-term restoration of hemlock forest are not promising under any alternative.

Oak Forest – The general pattern in development stage amounts of oak forest is similar to the patterns for mixed mesophytic/cove and northern hardwood forests, with large decreases in the mature stage and large increases in the old stage during the later decades of the planning horizon. However, the projections for oak forest development stage amounts show proportionally larger differences among alternatives because of larger differences in the way oak-dominated landscapes are allocated to MPs.

In addition to the projected changes in development stages based on harvest amounts and aging of existing stands, oak forest may experience changes in total amount due to species composition changes that are not reflected in the projections. Old oak stands, particularly those dominated by the shorter-lived and shade-intolerant oak species like scarlet oak (*Quercus coccinea*) and northern red oak (*Quercus rubra*), may experience a gradual shift toward mixed mesophytic and cove forest as the oaks are replaced by shade-tolerant species (see species composition discussion in the *Vegetation Management* section of this chapter). Such conversions could reduce total amounts of oak forest toward the estimated presettlement amount. Among the action alternatives, Alternative 3, which allocates the least land to the suitable timber base, has the lowest projected levels of harvest in oak forest, and maintains the current 300-acre annual cap on prescribed burning, is likely to cause the largest conversion of oak to mixed mesophytic. Alternative 4 has the most land in the suitable timber base and the highest projected harvest activity; therefore it is the action alternative that is likely to convert the least amount of oak forest to mixed mesophytic. Alternatives 2 and 2M have intermediate projected levels of harvest activity and are likely to convert less oak to mixed mesophytic than Alternative 3, but more than Alternative 4. Alternative 1 is similar to Alternatives 2 and 2M in projected levels of harvest, but, as the no action alternative, it keeps in place the current 300-acre annual limit on prescribed fire. Therefore, it is less likely than Alternatives 2 and 2M to maintain oak regeneration. However, because of higher harvest levels, Alternative 1 is more likely than Alternative 3 to maintain oak regeneration. It is difficult to predict whether any alternative would reduce the total amount of oak forest below the estimated presettlement amount, but Alternatives 1 and 3 appear to have a greater chance of doing so than Alternatives 2, 2M, and 4.

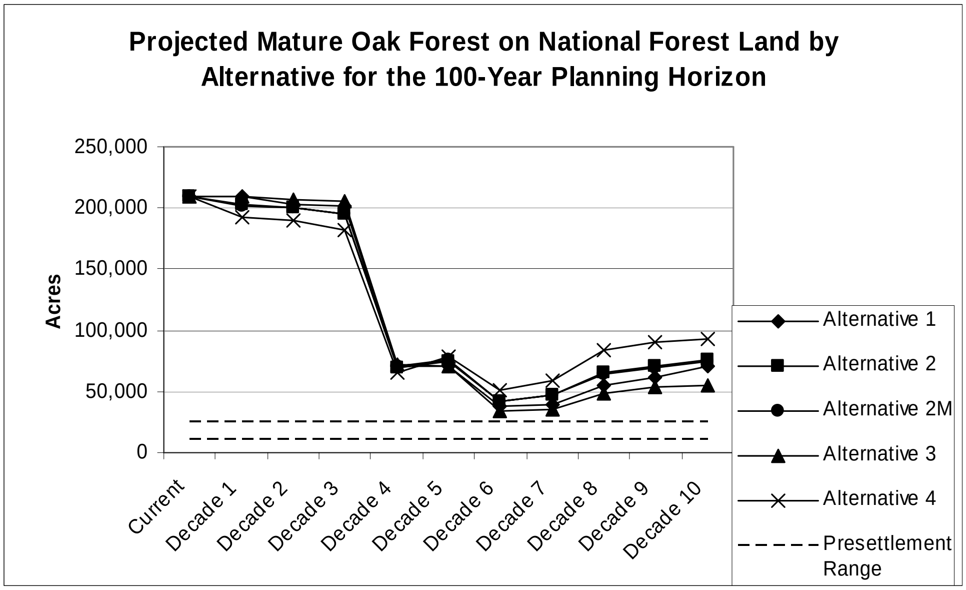
The projected amount of young oak forest shows a generally increasing trend under all alternatives for much of the planning horizon, with varying degrees of decline in the later decades (Figure ED-16). For the first six decades, Alternative 4 is projected to have the most harvesting in oak forest and hence the largest amount of young oak forest. Under this alternative, young oak forest is projected to peak at about 66,000 acres in the fourth decade. Alternative 3 has the least timber harvesting and the smallest projected amount of young oak forest during these decades, with about 35,000 acres in the fifth and sixth decades. Projected young oak forest for Alternatives 1, 2, and 2M is intermediate to Alternatives 3 and 4, reaching a little more than 50,000 acres in the sixth decade. In the seventh through tenth decades, young oak forest under Alternative 4 is projected to decline as the amount of timber harvest drops. Under the other alternatives, the amount of young oak forest is projected to level off in the seventh through ninth decades, declining only in the tenth decade. Alternatives 1, 2, 2M, and 4 are all projected to provide about 55,000 acres of young oak forest at the end of the planning horizon, whereas Alternative 3 is projected to provide approximately 35,000 acres at the end of the planning horizon. All alternatives are projected to increase young oak forest to levels well above the estimated presettlement range, although the projected amount under Alternative 3 should be somewhat closer to the presettlement range than the amounts projected for the other alternatives.

Figure ED-16.



The projected amount of mature oak forest shows the same general pattern across alternatives, with small differences in certain decades (Figure ED-17). The amount of mature oak forest is projected to remain high during the first three decades. Alternatives 1, 2, 2M, and 3 are projected to maintain around 200,000 to 210,000 acres during this time, while the amount under Alternative 4 is projected to decline somewhat to about 180,000 acres by the third decade. The small decline under Alternative 4 is due to higher levels of timber harvesting. Mature oak forest is projected to decline precipitously in decades 4 through 6 as many stands move into the old stage. The low point in the sixth decade is projected to range from about 34,000 acres to about 42,000 acres for Alternatives 1, 2, 2M, and 3. Alternative 4 is projected to produce about 51,000 acres of mature oak forest at the low point in the sixth decade. The projected amount is slightly higher for Alternative 4 than for the other alternatives because Alternative 4 is projected to harvest more in the early decades, and some of those harvested stands will have reached the mature stage by the sixth decade. The low point in the sixth decade would take the amount of mature oak forest near the estimated presettlement range for all alternatives, but under no alternative would mature oak forest decline enough to reach the presettlement range. For all alternatives, mature oak forest is projected to increase gradually in the seventh through tenth decades as previously harvested stands reach the mature stage. Alternative 4 has the highest levels of harvesting in the early decades, and is therefore projected to have the largest increase in mature oak forest in the later decades, reaching over 90,000 acres in the ninth and tenth decades. Alternative 3, which would have the least amount of harvesting in the early decades, is projected to have the smallest increase, reaching over 50,000 acres in the ninth and tenth decades. Alternatives 1, 2, and 2M are projected to produce about 70,000, to 75,000 acres of mature oak forest by the tenth decade.

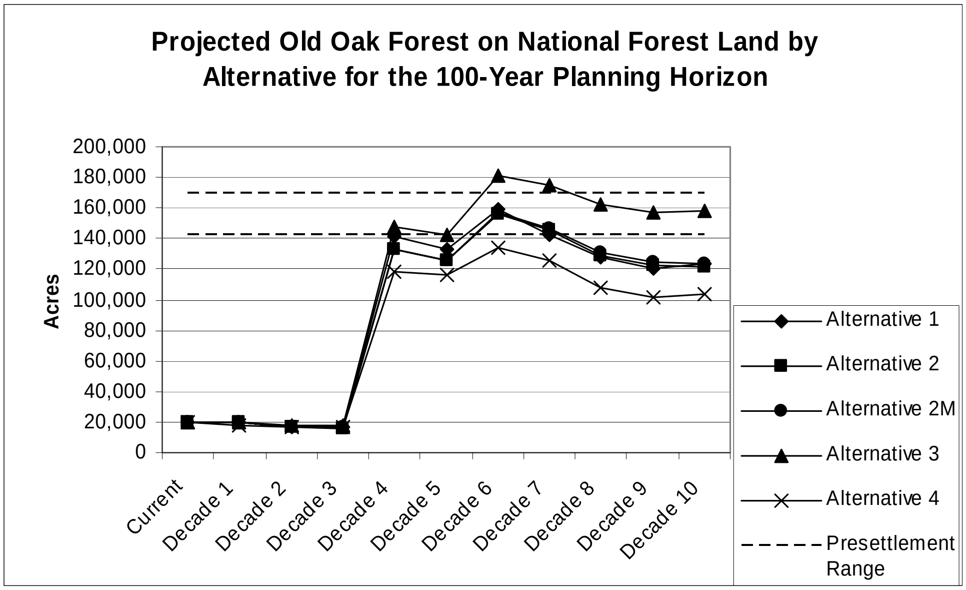
Figure ED-17.



Old oak forest also is projected to follow a similar pattern across alternatives, with widening differences among alternatives in the later decades of the planning horizon (Figure ED-18). For the first three decades of the planning horizon, all alternatives are projected to maintain old oak forest at or near the current amount of approximately 20,000 acres. Old oak forest is projected to increase rapidly during the fourth through sixth decades as currently mature stands age, with the largest increase occurring under Alternative 3 and the smallest increase occurring under Alternative 4. Alternative 3 is projected to produce about 180,000 acres at the peak in the sixth decade, whereas Alternative 4 is projected to produce about 130,000 acres at the sixth decade peak. Alternatives 1, 2, and 2M are each projected to peak at about 160,000 acres in the sixth decade. These differences among alternatives are due to differences in the amount of timber harvest, with higher amounts of harvesting reducing the amount of old oak forest. Under all alternatives, old oak forest is projected to decline gradually in the seventh and eighth decades as the rate of harvest begins to outpace the rate at which mature stands reach the old stage. The magnitudes of the differences among alternatives are projected to remain about the same throughout the sixth through tenth decades. By the end of the planning horizon, Alternative 3 is projected to produce about 160,000 acres of old oak forest, Alternatives 1, 2, and 2M are projected to produce about 120,000 acres, and Alternative 4 is projected to produce about 100,000 acres.

Alternatives 1, 2, 2M, and 3 produce enough old oak forest to reach the estimated presettlement range in certain decades. Under Alternative 3, old oak forest is projected to be within the presettlement range in the fourth, fifth, eighth, ninth, and tenth decades, and is actually projected to exceed the presettlement range in the sixth and seventh decades. Alternatives 1, 2, and 2M are projected to produce old oak forest amounts within the presettlement range in the sixth and seventh decades. Alternative 4 is not projected to produce enough old oak forest to reach the presettlement range in any decade.

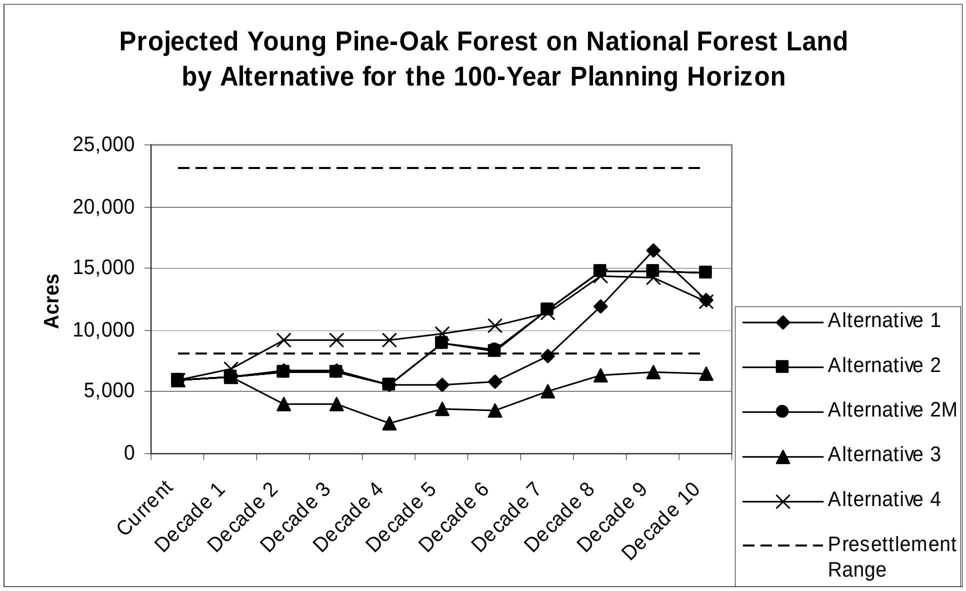
Figure ED-18.



Pine-Oak Forest – Projected development stages of pine-oak forest follow patterns similar to the other forested communities, with large decreases in the mature stage, large increases in the old stage, and fluctuations in the young stage that depend on the level of harvesting in a given alternative. Like oak forest, pine-oak forest is fire-adapted and is subject to similar potential changes in species composition in the absence of fire, timber harvest, or other disturbances.

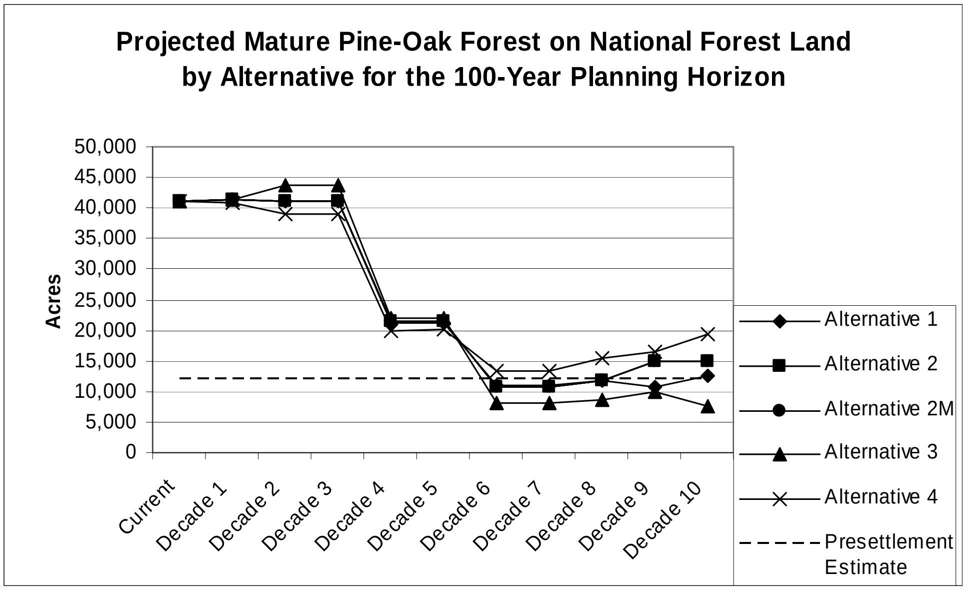
Each alternative exhibits a unique pattern in the projected amount of young pine-oak forest (Figure ED-19). For Alternative 1, minor fluctuations near the current amount of 6,000 acres are projected for the first six decades, followed by an accelerating increase to approximately 16,000 acres in the ninth decade. A decline to about 12,000 acres occurs in the tenth decade. Under Alternatives 2 and 2M, minor fluctuations around 6,000 acres are projected through the fourth decade. An increase to between 8,000 and 9,000 acres is forecast for the fifth and sixth decades. A continued increase to approximately 15,000 acres is projected for the eighth decade, with the amount leveling off near 15,000 acres for the ninth and tenth decades. Under Alternative 3, a gradual decline is projected for the early decades, with the amount reaching a low point of approximately 2,500 acres in the fourth decade. Thereafter a gradual increase occurs, with the amount leveling off at approximately 6,000 acres in the eighth through tenth decades. For Alternative 4, the amount of young pine-oak forest is projected to increase for the first two decades, leveling off at about 9,000 acres in the third and fourth decades. Beginning in the fifth decade, an accelerating increase is projected, with the amount peaking at about 14,000 acres in the eighth decade. A slight decline to about 12,000 acres is projected for the tenth decade. The differences among alternatives are directly related to the amount of timber harvest, with higher harvest amounts producing higher amounts of young pine-oak forest. Alternative 4 maintains amounts of young pine-oak forest within the estimated presettlement range for most of the planning horizon. Amounts projected for Alternatives 1, 2, and 2M are within the estimated presettlement range during several of the later decades, while the amount projected for Alternative 3 does not reach the estimated presettlement range.

Figure ED-19.



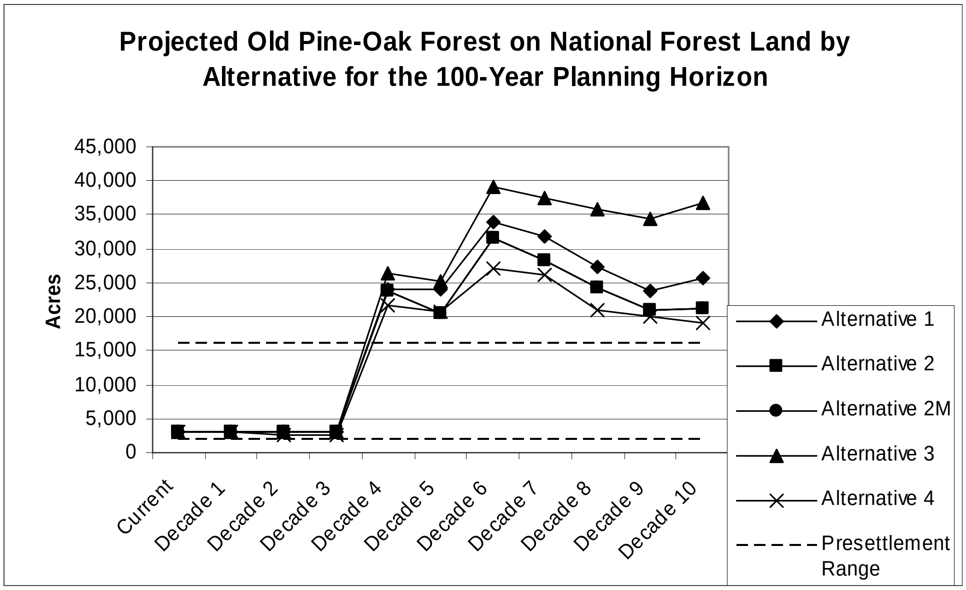
The projected amount of mature pine-oak forest follows a similar pattern under all alternatives, with small differences in certain decades due to differing amounts of timber harvesting (Figure ED-20). Alternatives 1, 2, and 2M maintain the current level of about 41,000 acres through the third decade. Alternative 3 shows a slight increase to about 44,000 acres in the second and third decades, whereas Alternative 4 shows a slight decrease to about 39,000 acres in the second and third decades. These minor differences are due to somewhat higher harvest levels in Alternative 4 versus somewhat lower harvest levels in Alternative 3, relative to Alternatives 1, 2, and 2M. For all alternatives, a large decline is projected in the fourth through sixth decades as current mature stands reach the old stage. Under Alternative 3, mature pine-oak forest reaches a low point of approximately 8,000 acres in the sixth and seventh decades. Under Alternative 4, the low point is approximately 14,000 acres. The difference is due to somewhat higher harvest levels under Alternative 4 in the early decades of the planning horizon; these harvests mean more stands are reaching the mature stage in the later decades of the planning horizon. Alternatives 1, 2, and 2M, with intermediate levels of harvesting in the early decades, reach a low point of about 11,000 acres in the sixth and seventh decades. For the remaining decades of the planning horizon, Alternative 4 shows a gradual increase to approximately 19,000 by the tenth decade. Alternatives 2 and 2M show a slight increase to about 15,000 acres in the ninth and tenth decades, while Alternatives 1 and 3 show little change for the last four decades of the planning horizon. The low levels of mature pine-oak forest in decades six through ten are near the estimated presettlement amount, although Alternative 4 maintains somewhat more than the presettlement amount, and Alternative 3 maintains somewhat less.

Figure ED-20.



The projected amount of old pine-oak forest shows a similar general pattern through time across alternatives, though differences in timber harvest amounts create large differences among alternatives in the later decades of the planning horizon (Figure ED-21). All alternatives maintain old pine-oak forest near the current 3,000 acres through the first three decades. As current mature stands reach the old stage, the amount of old pine-oak forest increases substantially in the fourth through sixth decades. The increase is greatest under Alternative 3, with the amount peaking at approximately 39,000 acres in the sixth decade. The increase is the smallest under Alternative 4, with a peak amount of about 22,000 acres in the sixth decade. The peak projected amount is intermediate under Alternatives 1, 2, and 2M, reaching about 32,000 to 34,000 acres in the sixth decade. A gradual decline through the later decades of the planning horizon is projected for all alternatives, although differences among alternatives due to varying timber harvest levels remain apparent. Alternative 3 provides a little over 35,000 acres of old pine-oak forest at the end of the planning horizon, whereas Alternatives 1, 2, 2M, and 4, with higher timber harvest levels, provide around 20,000 to 25,000 acres at the end of the planning horizon. For all alternatives, the amount of old pine-oak forest is projected to increase beyond the estimated presettlement range in the fourth decade and remain above the presettlement range for the remainder of the planning horizon. Alternative 3 exceeds the presettlement range by the largest margin, while Alternative 4 exceeds the presettlement range by the smallest margin.

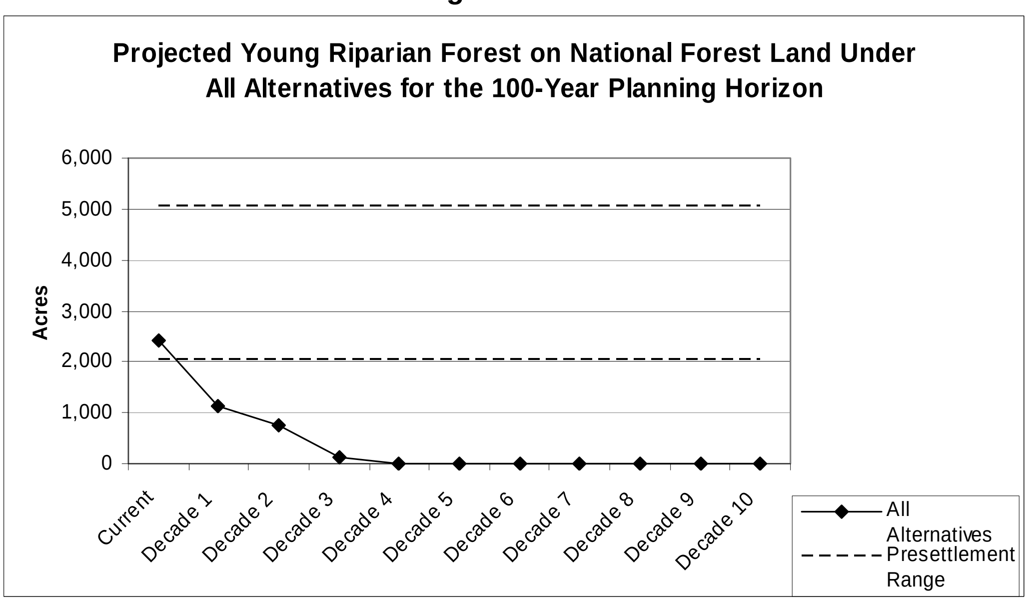
Figure ED-21.



Riparian Forest – All riparian forest is contained within channel management corridors, which is not subject to regulated even-aged timber management. Therefore, the amounts of riparian forest development stages are driven by natural forest development and disturbance processes, and do not differ by alternative.

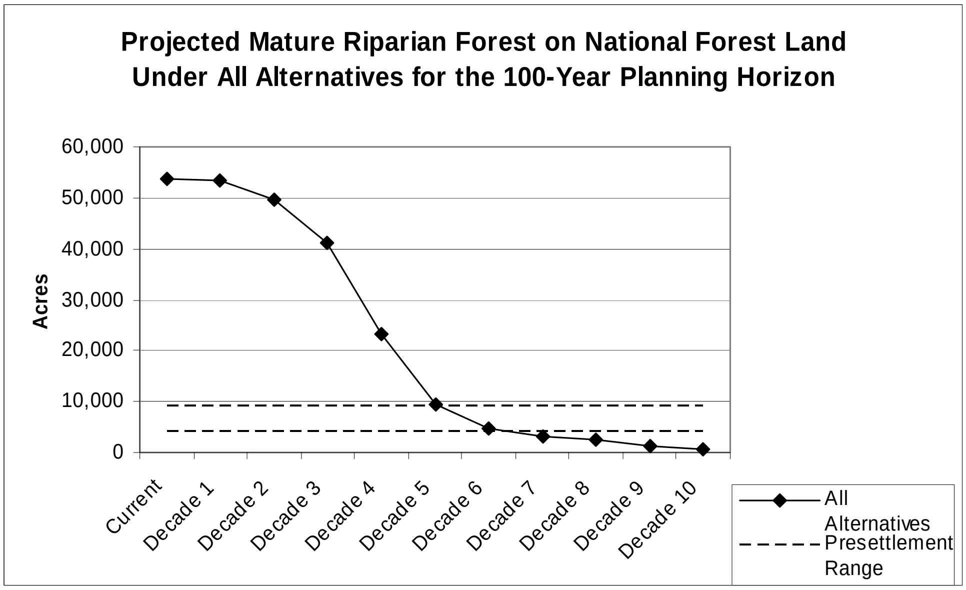
Young riparian forest is projected to decline to zero by the fourth decade and remain at that level for the rest of the planning horizon (Figure ED-22). The amount of young riparian forest stays below the estimated presettlement range for the entire planning horizon. However, the projections do not account for natural disturbances, which would likely create some young riparian forest.

Figure ED-22.



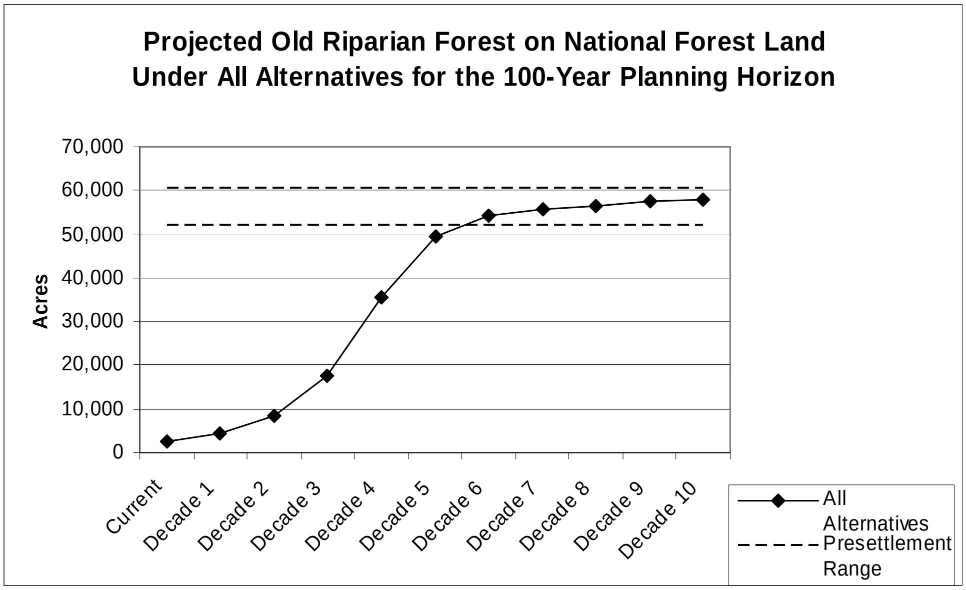
Mature riparian forest declines steadily through the early and middle decades of the planning horizon as current mature stands reach the old stage (Figure ED-23). The amount of mature riparian forest is projected to be less than 5,000 acres, which is below the estimated presettlement range, during the sixth through tenth decades. However, this projection does not account for the effects of natural disturbances, which could reset forest development in some areas and maintain higher than the projected amounts of mature riparian forest.

Figure ED-23.



Old riparian forest is projected to increase steadily throughout the early and middle decades of the planning horizon as stands continue to age in the absence of timber harvest (Figure ED-24). The amount levels off between 55,000 and 58,000 acres in the seventh through tenth decades. The amount of old riparian forest is projected to be within the estimated presettlement range in the sixth through tenth decades.

Figure ED-24.



Summary of Deviations Below Estimated Presettlement Ranges – For each alternative, the amount and development stage breakdown of each major forested community was evaluated relative to estimated presettlement amounts. Presettlement amounts provide a convenient yardstick with which to measure the effectiveness of a coarse-filter conservation strategy. However, effective community conservation does not necessarily require that community amounts be within their estimated presettlement ranges. Usually the exact amount of a given forested community development stage that is necessary for conserving the biological diversity associated with that community is unknown. For some communities, reaching the presettlement range within the planning horizon may not be possible because of past losses of that community. Also, maintaining all forested community development stages within their presettlement ranges could preclude meeting other multiple use goals and objectives, such as timber production and habitat for some game species. Plan alternatives must be evaluated in the context of such uncertainties and competing uses. Viewed in this context, the presettlement range becomes a tool for comparing the relative effectiveness of coarse-filter conservation among alternatives. Plan alternatives that provide amounts of a particular forested community development stage that are close to the presettlement range have a higher probability of conserving that community's biological diversity than plan alternatives that provide far less than the presettlement range. However, because we generally do not know the precise amount of a community that is necessary for effective conservation, a forested community development stage below the presettlement range should not automatically be interpreted as failure to conserve the biological diversity associated with that community.

A useful way to summarize the coarse-filter conservation implications of the amounts of forest development stages is to examine deviations below the estimated presettlement ranges. A large deviation below the presettlement range indicates potential difficulty in achieving coarse-filter ecosystem diversity conservation goals, whereas an amount within or above the presettlement range indicates ample representation of a community. For the projected amount of each major forested community development stage in each decade of the planning horizon, we calculated the percent deviation below the lower boundary of the estimated presettlement range. For cases where the projected amount was within or more than the presettlement range, the percent deviation was set to zero. Then, for each major forested community development stage under each alternative, we calculated the average, maximum, and minimum percent deviation below the presettlement range across the 10-decade planning horizon (Table ED-6). Hemlock forest was omitted because it was not modeled separately, and riparian forest was omitted because it is included in the other forested communities. A large deviation indicates a substantial shortfall relative to estimated presettlement conditions, while a zero deviation indicates sufficient representation relative to presettlement.

For all three development stages of spruce forest, deviations are relatively high, indicating potential difficulty in the coarse-filter conservation of natural community diversity (Table ED-6). These deviations are due to historic losses of spruce forest, the current concentrated age class distribution, and lack of projected timber harvest due to restrictions associated with West Virginia northern flying squirrel habitat. However, the deviations for spruce forest do not account for potential restoration of spruce forest, which could move mature and old spruce forest closer to their presettlement ranges during the middle and later decades of the planning horizon. Because of differing land allocations to MP 4.1, Alternative 4 is likely to restore the most spruce forest, while Alternative 1 is likely to restore the least. Among the action alternatives, Alternative 3 is likely to restore the least spruce forest. The deviations also do not account for natural disturbances, which could maintain young spruce forest closer to its estimated presettlement range under all alternatives.

For young and mature mixed mesophytic and cove forest, all three development stages of northern hardwood forest, young and mature oak forest, and old pine oak forest, percent deviations are zero under all alternatives (Table ED-6). These zero deviations indicate that all alternatives are projected to provide at least the minimum estimated presettlement amount of each of these forested community development stages throughout the 10-decade planning horizon. This indicates that all alternatives provide sufficient coarse-filter representation of these forested community development stages.

Four major forested community development stages show projected deviations below the estimated presettlement range that differ among alternatives. For old mixed mesophytic and cove forest, the action alternatives are projected to have somewhat smaller average and minimum deviations below the presettlement range than Alternative 1. Among the action alternatives, Alternative 3 is projected to have marginally lower average and minimum deviations than Alternatives 2 and 4. Thus, Alternative 3 has the highest probability of conserving biological diversity associated with old mixed mesophytic and cove forests. The differences among alternatives are due to different levels of timber harvest, with larger harvest amounts producing larger deviations below the presettlement range. However, the differences among alternatives are not pronounced, and all alternatives show large improvements relative to current conditions.

For old oak forest, the average and minimum deviations under all alternatives decline greatly relative to the current deviation, although there are differences among alternatives. The average deviation over the planning horizon is projected to be higher under Alternative 4 than under the other alternatives. Alternative 3 has a somewhat lower average deviation than Alternatives 1 and

2. The differences among alternatives are due to different amounts of timber harvest, with larger harvest amounts producing larger deviations below the presettlement range. These differences among alternatives would seem to suggest a higher potential to conserve old oak forest under Alternative 3, a lower potential under Alternative 4, and an intermediate potential under Alternatives 1, 2, and 2M. However, this indicator should be viewed with caution because of likely differences in prescribed fire that are not reflected in the development stage amounts. Because of the 300-acre annual cap on prescribed burning, Alternatives 1 and 3 are likely to have much less prescribed fire than Alternatives 2, 2M, and 4, which could lead to species composition shifts, conversion of old oak forest to other communities, and actual deviations below the presettlement range that are larger than the projected deviations shown in Table ED-6.

Table ED-6. Percent Deviation Below the Estimated Presettlement Range for Forest Development Stages of the Major Forested Communities by Alternative

Community Development Stage[1]	Current Percent	Average % Deviation Over 10 Decades				
		Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Young spruce forest	38	84	84	84	84	84
Mature spruce forest	0	33	33	33	33	33
Old spruce forest	96	65	65	65	65	65
Young mixed mesophytic/cove forest	0	0	0	0	0	0
Mature mixed mesophytic/cove forest	0	0	0	0	0	0
Old mixed mesophytic/cove forest	98	47	44	44	41	43
Young northern hardwood forest	0	0	0	0	0	0
Mature northern hardwood forest	0	0	0	0	0	0
Old northern hardwood forest	0	0	0	0	0	0
Young oak forest	0	0	0	0	0	0
Mature oak forest	0	0	0	0	0	0
Old oak forest	86	31	32	31	26	40
Young pine-oak forest	25	14	9	9	40	1
Mature pine-oak forest	0	3	2	2	15	0
Old pine-oak forest	0	0	0	0	0	0

Community Development Stage[1]	Current Percent	Maximum % Deviation Over 10 Decades				
		Alt. 1	Alt. 2	Alt 2M	Alt. 3	Alt. 4
Young spruce forest	38	100	100	100	100	100
Mature spruce forest	0	82	82	82	82	82
Old spruce forest	96	96	96	96	96	96
Young mixed mesophytic/cove forest	0	0	0	0	0	0
Mature mixed mesophytic/cove forest	0	0	0	0	0	0
Old mixed mesophytic/cove forest	98	98	98	97	98	97
Young northern hardwood forest	0	0	0	0	0	0
Mature northern hardwood forest	0	0	0	0	0	0
Old northern hardwood forest	0	0	0	0	0	0
Young oak forest	0	0	0	0	0	0
Mature oak forest	0	0	0	0	0	0
Old oak forest	86	88	89	89	87	89
Young pine-oak forest	25	31	30	30	69	15
Mature pine-oak forest	0	11	10	10	38	0
Old pine-oak forest	0	0	0	0	0	0

Community Development Stage[1]	Current Percent	Minimum % Deviation Over 10 Decades				
		Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Young spruce forest	38	26	26	26	26	26
Mature spruce forest	0	0	0	0	0	0
Old spruce forest	96	41	41	41	41	41
Young mixed mesophytic/cove forest	0	0	0	0	0	0
Mature mixed mesophytic/cove forest	0	0	0	0	0	0
Old mixed mesophytic/cove forest	98	16	9	9	4	7
Young northern hardwood forest	0	0	0	0	0	0
Mature northern hardwood forest	0	0	0	0	0	0
Old northern hardwood forest	0	0	0	0	0	0
Young oak forest	0	0	0	0	0	0
Mature oak forest	0	0	0	0	0	0
Old oak forest	86	0	0	0	0	5
Young pine-oak forest	25	0	0	0	18	0
Mature pine-oak forest	0	0	0	0	0	0
Old pine-oak forest	0	0	0	0	0	0

[1]Riparian forest is not shown because it overlaps the other communities and is included in them. Hemlock forest is not shown because it currently occupies a minor portion of the landscape and was not modeled separately in Spectrum. Large-scale vegetation management is not expected in either of these communities, so any deviations from presettlement ranges will not differ among alternatives

For young and mature pine-oak forest, Alternative 3 has substantially higher deviations than the other alternatives, while Alternative 4 has the lowest deviations. The differences among alternatives are related to timber harvest amounts, with smaller harvest amounts producing larger deviations below the presettlement range. Under Alternative 3, the average and maximum deviations increase greatly relative to current conditions. This indicates that Alternative 3 has a greater risk than the other alternatives of not conserving biodiversity associated with young and mature pine-oak forests. Alternative 4 has the highest potential for conserving biodiversity associated with young and mature pine-oak forests.

Amount of Each Rare and Unique Community

Most rare and unique communities are not projected to change from current amounts, regardless of alternative. Management activities generally would avoid these communities because of unsuitability for most land uses. In cases where management must occur within or near these communities, adverse impacts would be avoided or minimized to the extent possible, according to plan direction to conserve rare communities. Also, most of these communities are maintained by soil, topographic, or geologic conditions that are not likely to change naturally in the foreseeable future. Amounts of the following rare and unique communities are not expected to change substantially from current amounts regardless of alternative (Table ED-7):

- Bogs, fens, seeps, and seasonal ponds
- Open wetlands
- Stream channels
- Glades and barrens
- Rock outcrops and cliffs
- Shrub balds
- Caves and mines
- Lakes and ponds

However, three other communities that are classed with the rare and unique communities occur on a larger scale and are subject to changes in area because of Forest Service management. These communities are high-elevation grasslands; woodlands, savannas, and grasslands; and remote habitat.

Relative to the current amount, the amount of high-elevation grassland is projected to increase somewhat under all alternatives except Alternative 3, where it is projected to decrease slightly (Table ED-7). The projected increases are associated with meeting the desired condition for maintained openings in the MPs that are in the suitable timber base. The amount would decline in Alternative 3 because of a large decrease in land allocations to these MPs. The largest increase would occur under Alternative 4. Projected increases in high-elevation grasslands are held down by the prevalence of West Virginia northern flying squirrel suitable habitat in high elevations. In making these projections, we assumed that desired conditions for maintained openings would not be met in suitable West Virginia northern flying squirrel habitat. If desired conditions for maintained openings are not met in other areas, the total amount of high-elevation grasslands could stay the same or decline under Alternatives 1, 2, 2M, and 4.

Table ED-7. Projected Amounts of Rare and Unique Communities in Future Decades Compared to Estimated Presettlement, 1935, and Current Amounts

(NFS land only. All amounts are acres unless otherwise noted. Amounts in bold are within the estimated presettlement range or within +/- 5 percent of the estimated presettlement amount.)

Community	Presettle-ment Amount	1935 Amount	Current Amount	Alt. 1 Amount	Alt. 2 Amount	Alt 2M Amount	Alt. 3 Amount	Alt. 4 Amount
Bogs, fens, seeps, seasonal ponds	Unknown	Unknown	2,000	2,000	2,000	2,000	2,000	2,000
Open wetlands	Unknown	Unknown	1,000	1,000	1,000	1,000	1,000	1,000
Stream channels (miles)	3,000	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**	**3,000**
Glades and barrens	2,000	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**
Rock outcrops and cliffs	6,000	**6,000**	**6,000**	**6,000**	**6,000**	**6,000**	**6,000**	**6,000**
High-elevation grasslands	Unknown	22,000	14,000	17,000	16,000	16,000	13,000	18,000
Shrub balds	Unknown	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Caves/mines (entrances)	225	**225**	**225**	**225**	**225**	**225**	**225**	**225**
Woodlands, savannas, and grasslands	Unknown	40,000	7,000	15,000	14,000	14,000	10,000	15,000
Lakes and ponds	Unknown	Unknown	200	200	200	200	200	200
Total remote habitat	915,000	Unknown	190,000	200,000	220,000	240,000	410,000	150,000

Woodlands, savannas, and grasslands are projected to increase under all alternatives (Table ED-7). This community is projected to approximately double under Alternatives 1, 2, 2M, and 4; it is projected to increase a little more than 40 percent under Alternative 3. These are considered maximum potential increases assuming desired conditions for maintained openings will be met.

The amount of remote habitat is projected to vary greatly by alternative (Table ED-7). Because remote habitat was estimated using land allocated to MPs with a semi-primitive non-motorized emphasis, the differences among alternatives are a direct reflection of different allocations to these MPs. Remote habitat would be most extensive under Alternative 3, increasing from the current estimated 190,000 acres to 410,000 acres. In contrast, remote habitat under Alternative 4 would decrease to an estimated 150,000 acres. Under Alternatives 1, 2, and 2M, remote habitat would increase by moderate amounts, to about 200,000, 220,000, and 240,000 acres respectively.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth

The total amount of land contained in MDA reserves is highest in Alternative 3, which has 520,000 acres, or 57 percent of NFS land, in reserves (Table ED-8). Total land in MDA reserves is lowest in Alternative 1 at 310,000 acres, or 34 percent of NFS land. Alternatives 2, 2M, and 4 contain intermediate amounts of land in MDA reserves. Alternative 2 has 380,000 acres (42 percent of NFS land) in MDA reserves, Alternative 2M has 390,000 acres (43 percent of NFS land) in reserves, and Alternative 4 has 360,000 acres (39 percent of NFS land) in reserves. The differences among alternatives reflect different land allocations to MPs where large-scale even-aged management is not likely to occur. The MDA maps by alternative in the map packet show the locations of the reserves in each alternative.

Table ED-8. Minimum Dynamic Area Reserves by Alternative

Indicator	Alternative 1 Existing Condition	Alternative 2	Alternative 2M	Alternative 3	Alternative 4
Number of MDA reserves	10	10	10	14	9
Total acres in MDA reserves	310,000	380,000	390,000	520,000	360,000
Percent of all NFS Land in MDA reserves	34%	42%	43%	57%	39%
Percent of all Land in Forest Boundary in MDA reserves	18%	23%	23%	30%	21%

Spruce Forest - Representation of spruce forest in reserves does not vary substantially by alternative (Table ED-9, Figure ED-25). Under each alternative, MDA reserves contain over 45,000 acres of spruce forest. In Alternative 1, 95 percent of spruce forest on NFS land is contained in MDA reserves. In the remaining alternatives, 97 percent of spruce forest is contained in MDA reserves. This high degree of representation under all alternatives is due to the inclusion of most spruce forest in West Virginia northern flying squirrel suitable habitat. Thus, representative examples of natural processes and habitat structure in spruce forest have a high likelihood of being conserved under all alternatives. Over time, substantial core areas of old spruce forest are expected to develop under all alternatives.

Mixed Mesophytic and Cove Forest - Representation of mixed mesophytic and cove forest in MDA reserves is highest under Alternative 3 (47 percent of the community on NFS land) and lowest under Alternative 1 (29 percent of the community on NFS land). Alternatives 2 and 2M have 36 percent of the community on NFS land in reserves, while Alternative 4 has 33 percent in reserves (Table ED-9, Figure ED-25). While Alternative 3 conserves the largest amount of this community in MDA reserves, all alternatives conserve large amounts because this community is the most extensive community on the Forest. Even Alternative 1 conserves over 100,000 acres distributed among 10 different reserves. Therefore, representative examples of natural processes and habitat structure in mixed mesophytic and cove forest have a high likelihood of being conserved under all alternatives. Extensive core areas of old mixed mesophytic and cove forest are likely to develop under all alternatives.

Northern Hardwood Forest - Percentage representation of northern hardwood forest in MDA reserves is high under all alternatives, but does vary some among the alternatives (Table ED-9, Figure ED-25). Under Alternative 3, 84 percent of northern hardwood forest on NFS land is contained in MDA reserves, while Alternative 1 has 71 percent in reserves. Alternatives 2, 2M, and 4 have 81 percent of northern hardwood forest on NFS land in MDA reserves. While Alternative 3 has the largest representation of this community in reserves, northern hardwood forest is common on the landscape and, therefore, a large acreage of this community is contained in reserves under all alternatives. Alternative 1, which contains the lowest amount of this community in reserves, still has about 120,000 acres distributed among 9 reserves (Figures ED-8 and ED-25). Therefore, representative examples of natural processes and community structure are likely to be conserved under all alternatives. Large core areas of old northern hardwoods are likely to develop under all alternatives.

Hemlock Forest - Representation of hemlock forest in MDA reserves is highest under Alternative 3 (83 percent of the community on NFS land) and lowest under Alternative 1 (56 percent of the community on NFS land). Representation is similar for Alternatives 2, 2M, and 4, at 62 to 63 percent (Table ED-9). Although the percentage representation of this community is fairly high under all alternatives, the total area in reserves is less than 3,000 acres for each alternative (Figure ED-25). This low acreage is a result of the relative rarity of hemlock forest compared to the other forested communities. However, as mentioned previously, hemlock forest may be under-reported in the CDS database because it tends to occur in small groves that may have been included in other forest types. Regardless, the hemlock wooly adelgid poses a serious threat to this community, and it is unlikely that large core areas of old hemlock would develop under any alternative.

Oak Forest - Percentage representation of oak forest in MDA reserves varies widely by alternative. Alternative 3 has 42 percent of oak forest on NFS land in MDA reserves, while Alternative 1 has only 9 percent in reserves. Alternatives 2, 2M, and 4 have intermediate proportions of this community in reserves, at 16 percent, 16 percent, and 12 percent, respectively (Table ED-9, Figure ED-25). The potential consequences of these differences in representation are difficult to interpret. Higher representation in reserves would seem to favor conservation of natural processes and community structure, but on many sites long-term maintenance of oak forest depends on periodic disturbance. Therefore, the degree to which reserves conserve oak forest depends on the degree to which management of the reserves provides the necessary disturbance regime. From this perspective, Alternatives 2, 2M, and 4 would seem to have a greater chance than Alternative 1 of maintaining oak forest in MDA reserves. This is because the revised management direction for MP 6.2, the new direction for the NRA (MP 8.1), and the new direction for recommended Wilderness (MP 5.1) allow greater opportunities to use prescribed fire to mimic natural disturbance regimes. Also, Alternatives 2, 2M, and 4 would greatly increase the annual acreage limit on prescribed fire. However, access to conduct prescribed burning is likely to be limited in MPs 6.2 and 5.1 because of the current low road density and prohibitions on building new roads. Among the action alternatives, the acreage included in the NRA is equal, so the differences in representation of oaks in MDA reserves are due to differences in allocations to MPs 6.2 and 5.1. Therefore, representation in MDA reserves may actually serve as an inverse indicator for long-term maintenance of oak forest, especially under Alternatives 1 and 3, which maintain the current 300-acre annual limit on prescribed fire.

Pine-oak Forest - Percentage representation of pine-oak forest in MDA reserves also varies greatly among the alternatives. Alternative 3 contains 64 percent of all pine-oak forest on NFS land in MDA reserves, while Alternative 1 has 12 percent in reserves. Alternatives 2, 2M, and 4 put 22 percent, 22 percent, and 16 percent, respectively, in MDA reserves (Table ED-9, Figure ED-25). As with oak forest, on many sites pine-oak forest is maintained by periodic disturbance. Also similar to oak forest, the differences among the action alternatives are due to varying allocations to MPs 6.2 and 5.1. Thus representation in MDA reserves may actually be an inverse indicator of the potential for maintaining natural processes in pine-oak forest, especially for Alternatives 1 and 3.

Figure ED-25.

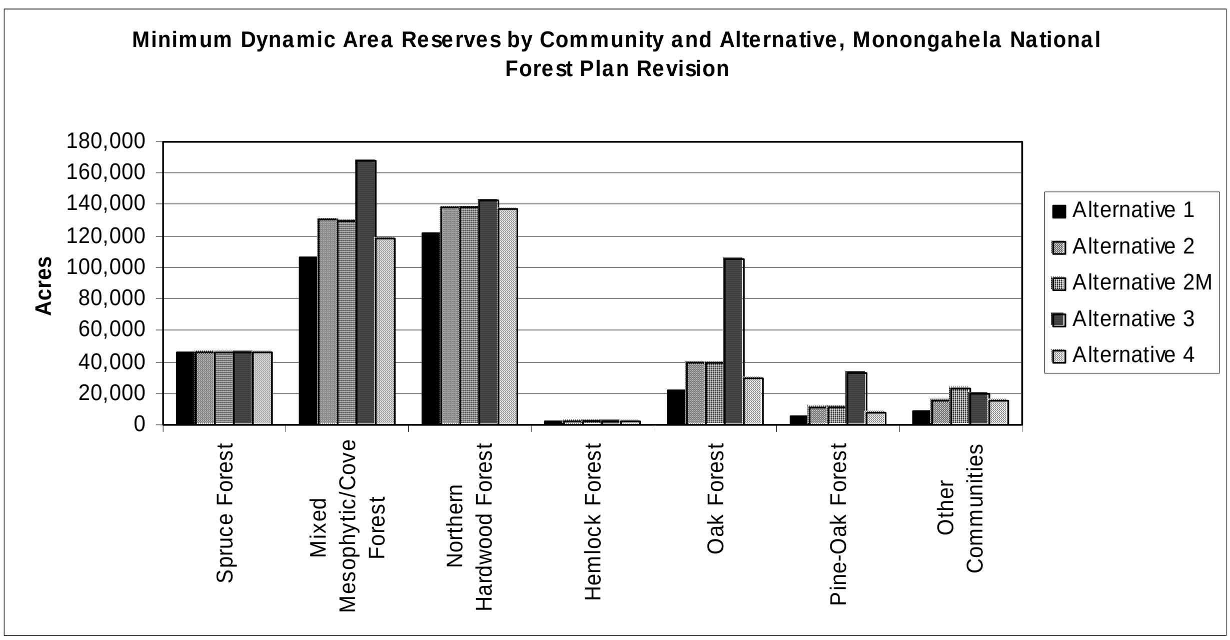


Table ED-9. Percent of Major Forested Communities within MDA Reserves[1]

Community	Percent of Current Community Amount on NFS Lands That is Contained in MDA Reserves				
	Alternative 1 Current Condition	Alternative 2	Alternative 2M	Alternative 3	Alternative 4
Spruce forest	95	97	97	97	97
Mixed mesophytic/cove forest	29	36	36	47	33
Northern hardwood forest	71	81	81	84	81
Hemlock forest	56	63	63	83	62
Oak forest	9	16	16	42	12
Pine-oak forest	12	22	22	64	16

[1]MDAs are blocks 10,000 acres or larger where even-aged management is prohibited or greatly limited.

Cumulative Effects

Amount and Development Stages of Major Forested Communities

The analysis of cumulative effects on the amount and development stages of major forested communities considers the potential effects of activities on all land in the Forest boundary, regardless of ownership. Because almost half of the land within the Forest boundary is not NFS land, private activities will account for a large share of the cumulative impacts of all activities within the Forest boundary. A variety of private activities have the potential to affect the amount and development stages of major forested communities, including timber harvest, oil and gas development, mining, residential and commercial development, and passive management that allows stands to grow older. Timber harvest and passive management have the greatest potential to affect forested communities over large areas. The other activities are likely to result in localized temporary or permanent losses of forested community acreage.

The likely extent of timber harvest on private land is difficult to project. However, FIA data for non-NFS land in the counties that contain the MNF offer some insight into current trends (data from FIA website). Based on FIA data from the 2000 inventory, annual timber volume growth exceeds volume removal by a ratio of approximately 1.6:1. Based on a comparison of data from the 1989 and 2000 inventories, the percentage of forestland that is sawtimber increased from about 66 percent to about 69 percent, while poletimber decreased from 23 percent to 21 percent and seedling/sapling stands decreased from 10 percent to 9 percent. These data suggest that harvesting on private land is not keeping up with growth. Over time, if this trend continues, the area of young forest will decrease, while the area of old forest will increase.

Cumulative effects on the total amount of each major forested community are likely to mirror the direct effects of management activity on NFS land. Gradual conversion of some areas of old oak and pine-oak to mixed mesophytic and cove forest is likely to occur on all ownerships within the Forest boundary. Because about two-thirds of current oak and pine-oak forest in the Forest boundary is on NFS land, aging of these communities on NFS land is expected to contribute to this cumulative trend. Among the action alternatives, Alternative 3 has the lowest projected amount of management activity to counter this trend, and is expected to make the largest contribution to the cumulative conversion of oak and pine-oak forest to mixed mesophytic/cove forest. Alternative 4 is the action alternative with the most projected management activity and is expected to have the lowest cumulative contribution, while Alternatives 2 and 2M would make intermediate contributions to the cumulative conversion of oak and pine-oak forest to mixed mesophytic/cove forest. Alternative 1 is similar to Alternatives 2 and 2M in projected levels of harvest, but, as the no action alternative, it keeps in place the current 300-acre annual limit on prescribed fire. Therefore, it is more likely than Alternatives 2 and 2M to make a measurable contribution to cumulative oak and pine-oak species composition shifts. Alternative 1 should cause less conversion of oak than Alternative 3 because it would have more harvesting. These cumulative effects cannot be quantified accurately enough to predict whether total amounts of oak and pine-oak forest within the Forest boundary would be reduced below the estimated presettlement range, or whether mixed mesophytic and cove forest would be increased above the estimated presettlement range.

Total amounts of spruce forest and northern hardwood forest may also exhibit cumulative trends within the Forest boundary due to active and passive restoration of spruce. Such restoration may cause an increase in the total amount of spruce forest and a decrease in the total amount of northern hardwood forest. Because almost all current spruce forest and about half of current northern hardwood forest are on NFS land, and because other land owners are not likely to engage in large-scale spruce restoration, active and passive restoration of spruce on NFS land is likely to account for most of the cumulative change in these two communities. This cumulative effect cannot be quantified well enough to predict whether total amounts of these communities will approach their estimated presettlement ranges within the Forest boundary.

Cumulative changes in forest development stages also are likely to occur within the Forest boundary. Increases in the old stage of all forest communities are projected on NFS land, and current trends suggest that the old stage will increase on other land ownerships as well. This increase in the old stage will occur as current mature stands age, so it will be accompanied by a corresponding decrease in the cumulative amount of the mature forest stage. Because NFS land makes up a little over half of the land in the Forest boundary, passive Forest Service management (allowing stands to grow older) is expected to make a substantial contribution to this cumulative increase in old forest and decrease in mature forest. As a result of this trend, the mature stage of most communities is expected to decline from its current very high level toward the presettlement range. The old stage of most communities is expected to rise from its current very low level toward the lower boundary of the estimated presettlement range. However, because of the difficulty in forecasting the magnitude and direction of future trends on private land, we cannot reliably forecast whether the cumulative amounts of any of the major forested communities will be within their respective presettlement ranges at any given point in the planning horizon. However, based on differences in the direct effects on NFS land, Alternative 3 would come closer than the other alternatives to the presettlement ranges for mature and old stages of most forest communities.

Cumulative changes in the young stage of each forested community are difficult to predict due to the offsetting effects of projected increases on NFS land versus the declining trend on non-NFS land. For mixed mesophytic/cove forest, northern hardwood forest, and oak forest, this offsetting cumulative effect is unlikely to keep young forest amounts below the estimated presettlement ranges under any alternative because the projected amounts on NFS land are well above the presettlement range. For pine-oak forest, which is projected to be near or below the lower boundary of the presettlement range on NFS land for much of the planning horizon, the chance is greater that cumulative amounts of young forest on all land ownership could drop below the presettlement range. Alternative 3, which has the least projected young pine-oak forest on NFS land, would have the greatest risk of falling below the presettlement range. Alternative 4, which has the most projected young pine-oak forest on NFS land, would have the best chance of maintaining the cumulative amount within the presettlement range for most of the planning horizon. For spruce forest, hemlock forest, and riparian forest, which have no scheduled harvest on NFS land under any alternative, cumulative young forest amounts could decline below the estimated presettlement ranges as the young stage of these communities declines across all ownerships. However, natural disturbances may offset this effect.

Amount of Each Rare and Unique Community

The analysis of cumulative effects to rare and unique communities considers the potential effects of activities on all land in the Forest boundary, regardless of ownership. For the following rare and unique communities, projected future amounts under all alternatives are projected to remain similar to current amounts (Table ED-10):

- Bogs, fens, seeps, and seasonal ponds
- Open wetlands
- Stream channels
- Glades and barrens
- Rock outcrops and cliffs
- Shrub balds
- Caves and mines
- Lakes and ponds

These projections assume that activities on non-NFS land will not greatly change the amounts of these communities due to legal and regulatory protections (bogs, fens, seeps, seasonal ponds; open wetlands; stream channels; lakes and ponds) or lack of suitability for most land uses (all of these communities). However, these should be considered maximum projections for three reasons. First, adjacent land uses could adversely impact these communities without violating legal and regulatory protections and without encountering use limitations related to soil and geology. Second, for those communities with legal and regulatory protection, permits that allow some level of impact can be obtained for many activities. Although the permits usually require mitigation measures, such measures do not always completely offset the impact. Third, some more intensive land uses may be able to modify the environment enough to overcome the soil and geology-related limitations (e.g., second home development, highway construction, strip mining).

Three other rare and unique communities are projected to change from existing conditions due to their broader-scale occurrence and a greater likelihood of change due to active management (or lack thereof). For all three communities, the amounts on non-NFS land are projected to remain similar in the future under all alternatives, so the differences among alternatives are all due to projected changes on NFS land. While a projection of no change on non-NFS land may not be entirely realistic, available information does not support any quantitative estimates of substantial change. However, for high elevation grasslands and woodlands, savannas, and grasslands, data from the Census of Agriculture (USDA 2004, 1999) suggest that recent trends in hay and pasture land have been flat. The vast majority of the acreage of these two communities consists of hay and pasture land. Therefore, these data lend some support to the assumption of no substantial change in acreage on non-NFS land. Also, because all of the differences relative to current amounts are due to anticipated management on NFS land, the projected amounts for these three communities highlight the contribution of Forest Service management to cumulative effects.

Table ED-10. Projected Amounts of Rare and Unique Communities in Future Decades Compared to Estimated Presettlement, 1935, and Current Amounts[1]

(All ownership within the Forest Boundary. All amounts are acres unless otherwise noted. "Unknown" denotes that there was no reliable way to determine this information.)

Community	Presettle-ment Amount	1935 Amount	Current Amount	Alt. 1 Amount	Alt. 2 Amount	Alt. 2M Amount	Alt. 3 Amount	Alt. 4 Amount
Bogs, fens, seeps, seasonal ponds	Unknown	Unknown	6,000	6,000	6,000	6,000	6,000	6,000
Open wetlands	Unknown	Unknown	3,000	3,000	3,000	3,000	3,000	3,000
Stream channels (miles)	6,000	**6,000**	**6,000**	**6,000**	**6,000**	**6,000**	**6,000**	**6,000**
Glades and barrens	5,000	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**
Rock outcrops and cliffs	26,000	**26,000**	**26,000**	**26,000**	**26,000**	**26,000**	**26,000**	**26,000**
High-elevation grasslands	Unknown	81,000	27,000	30,000	29,000	28,000	25,000	30,000
Shrub balds	Unknown	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Caves/mines (entrances)	340	**340**	**340**	**340**	**340**	**340**	**340**	**340**
Woodlands, savannas, and grasslands	Unknown	170,000	66,000	73,000	72,000	72,000	68,000	73,000
Lakes and ponds	Unknown	Unknown	700	700	700	700	700	700
Total remote habitat	1,700,000	Unknown	280,000	≤300,000	≤320,000	≤330,000	≤510,000	≤250,000

[1]For non-NFS land, we assumed amounts would remain similar to current amounts. This assumption was based on the unsuitability of a many of these communities for most land uses, Census of Agriculture data showing flat trends in hay and pasture land (USDA 1999, 2004), and lack of reliable data suggesting imminent changes.

High elevation grasslands on all land in the Forest boundary are projected to be similar under Alternatives 1, 2, 2M, and 4 (Table ED-10). These alternatives are projected to increase this community slightly from the current approximately 27,000 acres to approximately 28,000 to 30,000 acres. Under Alternative 3, high elevation grasslands are projected to decrease slightly, to approximately 25,000 acres.

Woodlands, savannas, and grasslands also are projected to change only slightly by alternative (Table ED-10). Although this community is expected to experience a large proportional change on NFS land (see direct effects above), when all land in the Forest boundary is considered, the changes due to Forest Service management are largely masked by the fact that a large percentage of this community is on non-NFS land. Under Alternatives 1 and 4, the total amount of this community on all land ownerships would increase from an estimated 66,000 acres to 73,000 acres. The projected amount under Alternatives 2 and 2M is similar (approximately 72,000 acres), while Alternative 3 would have the lowest projected amount (approximately 68,000 acres).

Even considering all land in the Forest boundary, changes to remote habitat could still be substantial, depending on the alternative considered. Alternative 3 is projected to increase total remote habitat in the Forest boundary from approximately 280,000 acres to as much as 510,000 acres. Alternatives 1, 2, and 2M would see smaller increases, to approximately 300,000, 320,000, and 330,000 acres, respectively. Alternative 4 is projected to produce a decline in total remote habitat, to approximately 250,000 acres. These projections should be considered the maximum potential remote habitat since they extrapolate forward existing amounts on non-NFS land. Any management on non-NFS land that changes semi-primitive non-motorized areas to a less remote ROS classification would result in less remote habitat than these projections.

Representation of Ecological Communities in MDA Reserves – Potential Old Growth

The assessment of cumulative effects of community representation in MDA reserves examines how much of each community is contained in reserves, relative to the total estimated presettlement amount of that community on all land ownerships in the Forest boundary. Viewing community representation in this context integrates the effects of past, present, and reasonably foreseeable actions on all land within the planning unit boundary.

Spruce Forest - Representation of spruce forest in MDA reserves relative to the estimated presettlement amount within the Forest boundary does not vary by alternative. All alternatives put an amount equal to 11 to 27 percent of the estimated presettlement amount on all land ownerships into MDA reserves (Table ED-11). Even though all alternatives put almost all current spruce forest on NFS land into reserves, the cumulative percentage representation in reserves relative to presettlement conditions is relatively low because of the early 20th Century decline in the overall amount of spruce forest. Current NFS land contains about 94 percent of current spruce forest in the Forest boundary, as well as about three-quarters of the acreage that was estimated to have been spruce forest in presettlement times. Therefore, there is very limited potential for other landowners to contribute to representation of spruce forests in reserves. However, MDA reserves that contain spruce forest form fairly cohesive units within the major high elevation parts of the Forest, so the potential for effective conservation of natural processes and community structure representative of spruce forests in the Forest boundary appears to be high (See MDA figures in the map packet).

Mixed Mesophytic and Cove Forest - Alternative 3 allocates 22 to 25 percent of the estimated presettlement amount of this community within the Forest boundary to MDA reserves, while Alternative 1 allocates 14 to 16 percent. Alternative 4 allocates 16 to 18 percent of the estimated presettlement amount to MDA reserves, and Alternatives 2 and 2M allocate about 17 to 20 percent (Table ED-11). The percentages may seem like low representation, but they represent large total acreages because this is the most extensive community within the Forest boundary. MDA reserves contain several large core areas of mixed mesophytic and cove forest that appear to offer a high likelihood of conserving natural processes, community structure, and potential old growth representative of this community within the Forest boundary. Notable examples include the Seneca Creek backcountry and surrounding lands, Otter Creek Wilderness and surrounding lands, Dolly Sods Wilderness, and the lower elevation backcountry areas surrounding Cranberry Wilderness (See MDA figures in the map packet). These core areas exist in all alternatives, but are largest in Alternative 3 and smallest in Alternative 1.

Current NFS ownership contains approximately 58 percent of the current amount of mixed mesophytic and cove forest within the Forest boundary, and about 46 to 51 percent of the acreage that was estimated to have been occupied by this community during presettlement. Therefore, activities that occur on other ownerships have a large potential to affect the overall conservation of this community within the Forest boundary. While some acreage of this community is included in state parks and a federal wildlife refuge that have some potential for conservation, the great majority of the non-NFS acreage of this community is privately owned. Private landowners typically are interested in generating an economic return from their property, and large numbers of private landowners are unlikely to coordinate their management to preserve large blocks of land. Therefore, it is unlikely that this private acreage will make a substantial cumulative contribution to conservation of mixed mesophytic and cove forest in large, cohesive MDA reserves.

Northern Hardwood Forest - Representation of northern hardwood forest in MDA reserves relative to the estimated presettlement amount is high under all alternatives, ranging from ≥93 percent under Alternative 1 to ≥110 percent under Alternative 3 (Table ED-11). This very high representation is due to the increase in northern hardwood forest that occurred as spruce forest and hemlock forest were decimated by extractive logging early in the 20^{th} Century. Also, much of this community still contains a minor conifer component and is included in West Virginia northern flying squirrel suitable habitat. In addition to representing essentially all of the estimated presettlement extent of this community, the acreage comprises several cohesive core areas in the major high elevation areas of the Forest. MDAs with a strong representation of northern hardwood forest include the Cranberry-Gauley Mountain, Cheat Mountain, East Fork Greenbrier, Laurel Fork, and Canaan Loop areas (See MDA figures in the map packet). These core areas occur in all alternatives, with little variation in size between the alternatives with the most (Alternative 3) and least (Alternative 1) amounts of this community. Thus MDA reserves appear to offer a very high likelihood that representative natural processes, community structure, and potential old growth characteristic of this community within the Forest boundary will be conserved. Also, northern hardwood forest within MDA reserves is intermingled with spruce forest, and in many places occupies sites that are believed to have been spruce forest prior to extractive logging. Therefore, the high representation of northern hardwood forest in MDA reserves provides the potential to increase representation of spruce forest through active and passive restoration.

Current NFS ownership contains about half of the current amount of northern hardwood forest within the Forest boundary. Because of the post-extractive logging increase in northern hardwoods at the expense of spruce and hemlock, the current amount of northern hardwoods on NFS land amounts to more than the total estimated presettlement amount within the Forest boundary. However, given that about half of the current amount of this community within the Forest boundary is on non-NFS land, other landowners have a large potential to affect the conservation of this community, and, ultimately, the restoration of parts of this community to spruce forest. The vast majority of non-NFS land is privately owned. Therefore, for the same reasons stated above for mixed mesophytic and cove forest, it is unlikely that private acreage will make a substantial cumulative contribution to conservation of northern hardwood forest in large, cohesive MDA reserves.

Hemlock Forest - Cumulative representation of hemlock forest in MDA reserves, relative to the estimated presettlement amount of this community, does not vary by alternative. Because of the large losses of this community following extractive logging, and possibly because the community is not tracked well by the CDS database, representation of this community in MDA reserves relative to the total estimated presettlement amount within the Forest boundary is a trivial 1 to 2 percent under all alternatives (Table ED-11). Because of the possibility that the community is underrepresented in the CDS database, cumulative representation in reserves may be somewhat better than it appears. However, without substantial restoration efforts, it appears unlikely that enough of this community is present in reserves under any alternative to ensure long-term cumulative conservation of community processes and structure within the Forest boundary. The threat from the hemlock wooly adelgid makes such large-scale restoration seem unlikely in the foreseeable future.

Currently, about 38 percent of existing hemlock forest in the Forest boundary is on NFS land. NFS land contains about 43 to 49 percent of the area that was estimated to have supported hemlock forest during the presettlement period. Thus actions of other landowners may play a large role in the conservation of existing hemlock forest and the possible restoration of the community. Nearly all of the acreage on non-NFS land is privately owned, so the potential for a substantial contribution of other landowners to cumulative conservation of hemlock forest in MDA reserves within the Forest boundary is very low.

Oak Forest - Representation of oak forest in MDA reserves relative to the estimated presettlement amount within the Forest boundary varies greatly by alternative. Alternative 3 allocates an amount equal to approximately 30 percent of the estimated presettlement amount to MDA reserves, whereas Alternative 1 allocates 6 percent. Allocations to MDA reserves in Alternatives 2, 2M, and 4 are also low relative to Alternative 3, at 11, 11, and 8 percent, respectively (Table ED-11). However, as was discussed above under direct and indirect effects, allocation of oak forest to MDA reserves under the action alternatives may serve as an inverse indicator of the degree to which natural processes and community structure are maintained, particularly for Alternatives 1 and 3, which maintain the current 300-acre annual limit on prescribed burning.

About two-thirds of current oak forest within the Forest boundary is on NFS land, and NFS land contains about half of the acreage that was estimated to have been oak forest during the presettlement period. Thus, non-NFS land owners have the potential to affect cumulative conservation of oak forest. Although Watoga State Park and Calvin Price State Forest contain a large, cohesive unit of oak forest within the Forest boundary in the Marlinton-White Sulphur district, the vast majority of the oak forest sites that are not on NFS land are in private ownership. Because private landowners generally seek a financial return from their land, they have the potential to conduct management activities that could mimic to some degree the disturbance processes that maintain oak forests. However, it is difficult to predict the degree to which private management will use silvicultural techniques that maintain oak forests versus techniques that hasten the conversion of oak forests to dominance by other species (e.g., diameter limit cutting). Because of this uncertainty, and because it is unlikely that owners of intermingled private parcels will coordinate their management to perpetuate oaks, there is no reason to expect a substantial contribution by private land owners to the cumulative conservation of natural processes and structure in oak forests.

Pine-Oak Forest - Representation of pine-oak forest in MDA reserves relative to the estimated presettlement amount within the Forest boundary varies greatly by alternative. Alternative 3 assigns to MDA reserves an amount equal to about 48 percent of the estimated presettlement amount of pine-oak forest on all land ownerships within the Forest boundary. Alternative 1 has the least cumulative representation of pine-oak forest, with MDA reserves containing 9 percent of the estimated presettlement amount of pine-oak forest within the Forest boundary. Alternatives 2, 2M, and 4 allocate 16, 16, and 12 percent, respectively, to MDA reserves (Table ED-11). As with oak forest, allocation to MDA reserves under the action alternatives may serve as an inverse indicator of the degree to which natural processes and community structure are maintained, particularly for Alternatives 1 and 3, which maintain the current 300-acre annual limit on prescribed burning.

Table ED-11. Percent Representation of Ecological Communities in MDA Reserves, Cumulative Effects

Community	Percent of Estimated Presettlement Amount on All Ownerships Within Forest Boundary That is Contained in MDA Reserves				
	Alternative 1 Existing Condition	Alternative 2	Alternative 2M	Alternative 3	Alternative 4
Spruce forest	11 – 27	11 – 27	11 – 27	11 – 27	11 – 27
Mixed mesophytic/cove forest	14 – 16	17 – 20	17 – 19	22 – 25	16 – 18
Northern hardwood forest	93+	106+	106+	110+	106+
Hemlock forest	1	1 – 2	1 – 2	2	1 – 2
Oak forest	6	11	11	29 – 30	8
Pine-oak forest	9	16	16	48	12

An estimated 61 percent of current pine-oak forest within the Forest boundary is on NFS land. A little more than half of the acreage within the Forest boundary that was identified as having been pine-oak forest during the presettlement period is on NFS land. Thus non-NFS land owners have the potential to affect cumulative conservation of pine-oak forest within the Forest boundary. Almost all of the non-NFS pine-oak forest is privately owned. As with oak forest, it is difficult to predict whether management of these forests will provide disturbance regimes that maintain pine-oak forests versus disturbance regimes that hasten their demise. Because of this uncertainty, and because it is unlikely that owners of intermingled private parcels will coordinate their management to perpetuate this community, there is no reason to expect a substantial contribution by private land owners to the cumulative conservation of natural processes and structure in pine-oak forests.

Terrestrial Species Viability (Fine Filter)

INTRODUCTION

As noted in the *Terrestrial Ecosystem Diversity* section, the National Forest Management Act (NFMA) and its implementing regulations require national forests to preserve and enhance the diversity of plant and animal communities to meet multiple use objectives based on the suitability and capability of the land. The regulations further require maintenance of viable populations of existing native and desirable non-native species (16 U.S.C. 1600(6)(g)(3)(B); 36 CFR 219.19, 219.26, and 219.27(g)).

Species viability was not identified as a major Need for Change issue. It was identified as a minor Need for Change issue, not because it is not important, but because the 1986 Forest Plan, including its recent amendment for threatened and endangered species, was believed to provide for viability. Also, viability issues are partly addressed by the Vegetation Management and Backcountry Recreation issues.

The species viability fine-filter analysis is the second half of the coarse filter/fine filter approach to conserving biological diversity (see *Terrestrial Ecosystem Diversity* section). Fine-filter analysis focuses on maintaining viable populations of individual species that are identified as having potential viability concerns. Fine-filter analysis can serve as verification that the coarse-filter component is working, as well as a safety net to identify species-specific conservation actions that are necessary for maintaining viable populations of species that are not adequately conserved by the coarse-filter approach (Haufler et al. 1999).

This section analyzes overall effects of the Forest Plan alternatives to viability of all terrestrial species with potential viability concerns. Viability evaluations for aquatic species are described in the *Water, Riparian, and Aquatic Resources* section of this chapter. Cave-dwelling species were grouped with the terrestrial species, even though many of them are associated with aquatic systems within caves.

This analysis considers differences in broad patterns of viability risk across alternatives, and relates those patterns to management effects on ecological communities. While viability risks experienced by individual threatened and endangered species contribute to these patterns, detailed species-by-species analyses for threatened and endangered species are contained in the *Threatened and Endangered Species* section of this chapter.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect the level of risk to species with potential viability concerns, and may also be used to provide a mix of habitats for the species found on the Forest.

Background

Maintenance of species viability is an integral component of the Forest Service's responsibility to conserve biological diversity. The fine-filter analysis focused on species that may have viability concerns within the Forest boundary or have been identified by others as species of concern due to declining populations or other factors.

As part of its strategy to address NFMA viability requirements and avert the need for listing under the Endangered Species Act (ESA), each region of the Forest Service has developed a list of Regional Forester's Sensitive Species (RFSS), which are species for which population viability may be a concern. Direction in the Region 9 supplement to the Forest Service Manual emphasizes maintaining viability for RFSS and ensuring that management activities do not result in trends toward federal listing (FSM 2670.22, 2670.32). Manual direction requires Forests to determine whether their actions will affect RFSS, and if so, whether the actions will result in a loss of viability or a trend toward federal listing (FSM 2670.32).

Indicators

Distribution of viability outcomes by alternative - As a measure of the aggregate level of risk to species viability, the numbers of A, B, C, D, and E viability outcomes (explained below under Analysis Methods) were compared across the alternatives. For each alternative, we assessed the number of species that showed increased or decreased risk relative to existing conditions, and we interpreted these changes relative to projected trends in key communities. Particular emphasis was placed on species that changed to a higher risk viability outcome.

Effect determinations for Regional Forester's Sensitive Species by alternative - Viability outcomes, the rating information used to develop the outcomes, and changes relative to existing conditions were used to make effect determinations for RFSS. These effect determinations were used as a direct measure of each alternative's potential to impact RFSS. See the Current Conditions section below for elaboration on viability outcomes and effects determinations, and how they were determined.

Scope of Analysis

After screening hundreds of species for potential viability issues, the Species Viability Evaluations (see project record) assessed and documented in detail the past and ongoing threats to over 200 species and their habitats across their known ranges. These ranges varied from specific local caves to wintering habitat as far away as Central and South America. The viability outcomes were applied to the species' range within the Monongahela National Forest (MNF) proclamation boundary and purchase units in order to determine the potential effects of activities that may occur on National Forest System (NFS) lands and other land ownerships within and adjacent to that boundary. Therefore, these outcomes address the direct and indirect potential effects of National Forest management under the plan alternatives, but they also integrate the cumulative effects of National Forest management with other past, present, and reasonably foreseeable future actions on other land ownerships. Rationales for the viability factor ratings (in project record) explain the relative contributions of direct effects due to Forest management and cumulative effects that arise when actions on other land ownerships are considered.

Viability outcomes were developed for the current condition/immediate future as part of the Analysis of the Management Situation (AMS). For this EIS analysis, viability outcomes for each alternative were projected for the 100-year planning horizon. In making these projections across the planning horizon, habitat trends and fluctuations that are projected to occur in the middle of the planning horizon were considered, as well as the amounts projected to occur at the end of the planning horizon. Therefore, the outcomes account for habitat bottlenecks or deviations that might occur during the planning horizon, in addition to the overall trends. Analysis of viability risks for the entire planning horizon allowed us to evaluate the effects of management through a period when existing forest communities will age substantially relative to current conditions. The entire planning horizon also allowed time for management strategies to make progress toward desired conditions. Limiting the analysis to the early decades of the planning horizon would have ignored important changes in the age structure of forested communities in later decades that will result from the current condition and the effects of management activity in the early decades. However, projections beyond the first decade or two must be viewed with caution because of the potential for changes in management emphasis, as well as substantial uncertainty over factors beyond the control of the Forest, such as continued acid deposition, global climate change, human population growth, effects from non-native invasive species and other disturbance agents, and changes in wintering habitat for migratory species.

CURRENT CONDITIONS

Analysis Methods

We began the fine-filter analysis by selecting a group of species that may have viability concerns within the Forest boundary or have been identified by others as species of concern due to declining populations or other factors. In addition to globally rare species and other species with range-wide population concerns, this group also included species that are rare on the Forest, but common elsewhere. Such an approach ensured that we were considering all species with possible viability concerns on the Forest. Specifically, we selected species for individual analysis if they met one or more of the following criteria:

- Species that are federally listed as threatened or endangered, as well as species that have been formally proposed for such listing.

- Species that are listed by the Forest Service as RFSS for the Monongahela.

- Species with a NatureServe/Natural Heritage Program global abundance ranking of G1 (critically imperiled), G2 (imperiled), or G3 (vulnerable).

- Species with a West Virginia Natural Heritage Program state rank of S1, S2, or S3.

- Species with a NatureServe/Natural Heritage Program Forest rank for the MNF of F1, F2, or F3. Forest ranks were developed by NatureServe as part of a species viability evaluation database constructed for Region 8 of the Forest Service (NatureServe 2002). Although the MNF is not part of Region 8, the database covered many of the species with potential viability concerns on the MNF and assigned F ranks specific to the MNF.

- Birds on the Audubon Society's watch list.

- Birds identified by Partners in Flight as priority species for the Mid-Atlantic Ridge and Valley physiographic area (which includes the Monongahela).

- Migratory birds identified by the U.S. Fish and Wildlife Service as Birds of Conservation Concern for the Appalachian Mountains.

- For migratory birds, only breeding season populations were assessed.

Within this group of species, any that had previously been evaluated for the RFSS list, but were found not to warrant inclusion on that list, were dropped from further consideration. The RFSS process continually considers G1-G3, N1-N3, and S1-S2 species using a risk evaluation process that considers abundance, distribution, population trends, habitat integrity, and population vulnerability. RFSS risk evaluations are key building blocks in an ongoing process for addressing viability issues. Therefore, species that had already been considered but not selected for the RFSS list were deemed to have been evaluated adequately prior to this viability evaluation. However, a few exceptions to this rule were made for species of high public interest (e.g., cerulean warbler), which were carried through the analysis even if they had previously been dismissed from the RFSS list.

Based on comments on the Draft EIS, we added five plant species to the detailed analysis. The information sources listed above did not show occurrences of these species within the MNF, but the The Nature Conservancy presented information indicating that they do occur on the MNF and that they meet one or more of the rarity criteria outlined above. Also based on public comments, we added a crayfish that was evaluated only as an aquatic species in the Draft EIS.

A total of 457 species were screened specifically for this analysis, all of which came from either the NatureServe Region 8 viability database, one of the lists mentioned above, or public comments on the Draft EIS. Therefore, the species screened were those that have been identified as species with viability concerns somewhere within the southern United States, the Appalachian Mountains, or West Virginia. A comprehensive list of all species that occur on the Forest does not exist. However, the NatureServe/Natural Heritage Program rankings that were the main basis for the screening are considered to be the authoritative source on rare and declining species. In effect, the work done by NatureServe to identify rare and declining species means that essentially all species have been screened. From the 457 potentially rare or declining species that were considered in this analysis, the screening process produced a list of 219 species to be evaluated in detail (see Appendix D). These species included 14 mammals, 60 birds, 5 amphibians, 5 reptiles, 53 invertebrates, 75 vascular plants, and 7 nonvascular plants.

Each species carried forward for detailed analysis was assigned to one or more habitat associations. Habitat associations were based on those presented in NatureServe's viability database for Region 8 (NatureServe 2002). Habitat associations from this database were modified to better reflect known species-habitat relationships on the Monongahela (see Appendix D). The habitats used for the fine-filter analysis generally equate to the communities used in the coarse-filter analysis.

Because of the large number of species evaluated and a lack of detailed information for many of them, quantitative population viability analysis was not a practical way to assess species viability. Instead, we chose to use a qualitative rating system that produced a viability outcome for each species. Terrestrial viability outcomes were modified from those used in forest plan revision for the White Mountain National Forest, the Chippewa and Superior National Forests, and the Midewin National Tallgrass Prairie. These in turn were based on viability outcomes developed for the Interior Columbia River Basin Ecosystem Management Project (Quigley et al. 1996). The distribution and abundance combinations contained in the outcomes represent a range of likely risk to viability. The outcomes do not make a yes-or-no determination of viability, which is generally precluded by a lack of detailed demographic information.

Outcome A: The species is generally common and broadly distributed within its historic range in the planning area. Occurrences within the planning area interact as a metapopulation.

Outcome B: The species is either broadly distributed or locally common across its historic range in the planning area, but gaps exist within this distribution. For species associated with unique habitats, such gaps may represent the natural condition. Many occurrences are large enough and close together enough to permit metapopulation interactions, but a minority of occurrences may be isolated.

Outcome C: The species has low abundance and/or is distributed in a patchy pattern of disjunct occurrences. For species associated with unique habitats, low abundance and patchy distribution may be the natural condition. Many occurrences are isolated, whereas others are still able to interact as a metapopulation.

Outcome D: The species has low abundance and is distributed as isolated occurrences. While some occurrences may be self-sustaining, metapopulation interactions are not possible for most occurrences. This outcome may represent the natural condition for some species associated with unique habitats.

Outcome E: The species has very low abundance and is distributed as isolated occurrences. Many occurrences have a strong potential for extirpation, and metapopulation interactions are not possible.

Insufficient Information: Lack of information precludes assigning a viability outcome.

To arrive at viability outcomes in a consistent fashion for all species, we developed a set of factors upon which each species was rated:

- Habitat abundance refers to the total amount of habitat for the species within the Forest boundary. The rating was based on individual species' needs and considered the amount of habitat relative to the historic maximum and minimum amounts. Trends in habitat amount from presettlement times to the present were considered. If known threats made a portion of the habitat unsuitable for the species, we attempted to exclude that portion of the habitat from the estimate of habitat abundance. Habitat abundance was rated as common, occasional, or rare.

- Habitat distribution and connectivity describes the arrangement of habitat on the landscape. Essentially, it gauges how well the habitat satisfies NFMA's "well distributed" criterion. It is intended to represent the potential for interaction and genetic interchange among occurrences within the planning area. Therefore, this factor rating is strongly tied to the dispersal distance and mobility of the species being considered. In formulating this rating, we also considered the degree of connectivity relative to the historic maximum and minimum. Habitat connectivity was rated as connected, patchy, or isolated.

- Population factors represent the ability of the species to fully occupy available habitat. Having abundant, well-connected habitat does not ensure a species' viability if its mortality is so high or reproductive and dispersal rates are so low that it cannot produce enough individuals to fill the habitat. In this context "threats" refer to factors that cause abnormally high mortality, abnormally low reproductive rates, or restrict dispersal, to the extent that these factors are not already accounted for in the habitat ratings. Threats might include such factors as human disturbance, competition from exotic species, or micro-scale fragmentation that cannot be captured in the habitat ratings. To the extent allowed by available information, the population factors ratings considered historic and current trends in species distribution and abundance. Population factors were rated as low, moderate, or high risk.

The species viability chapter of the AMS contains additional detail on the factor ratings and how they were used to assign viability outcomes.

Distribution of Viability Outcomes

For the assessment of current conditions, 86 percent (189 of 219) of the fine-filter species evaluated in detail were assigned viability outcomes of C, D, or E (see Appendix D), indicating low abundance and some degree of risk to viability. Fifty-nine percent (129) of the species were assigned outcomes of D or E, indicating low abundance, fragmentation/isolation problems, and a relatively high risk to viability. These results are not surprising given that only species with potential viability concerns were evaluated in detail in this analysis. Numerous more common species occur on the Forest, but they were assumed to have little or no risk to viability and were screened out in the initial stages of this evaluation. Considering all 457 species that were screened specifically for this analysis, 41 percent received C, D, or E outcomes, and 28 percent were assigned D or E outcomes. Because the total number of species on the Forest is not known, it is not possible to calculate the percentage of all species on the Forest that received outcomes indicating risk to viability, but it is likely to be much lower than the percentage of species that were screened specifically for this analysis. The project record contains the data forms for all species that were evaluated in detail.

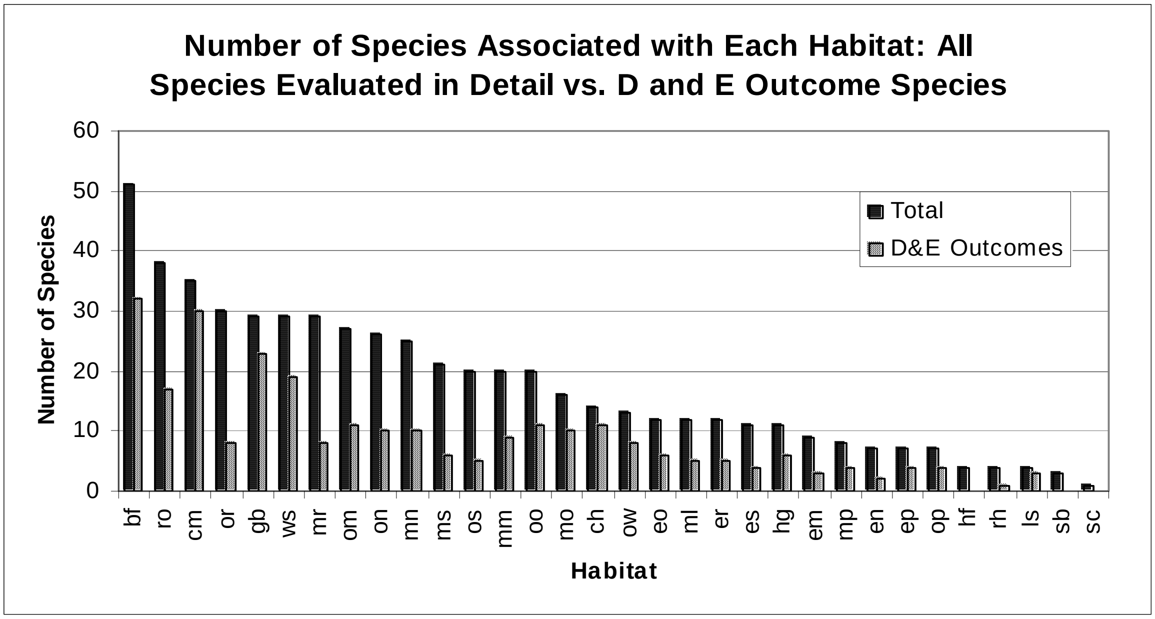
Although the best available information was used, lack of information also may have contributed to the high proportion of high-risk outcomes. Many species are known from only a few occurrences on the Forest. It is likely that little systematic survey work has been done for many of these species, so it is possible that the low number of known occurrences could overstate the degree of rarity for these species. In such cases, viability outcomes were assigned by erring on the side of caution; we assumed in most cases that the paucity of records indicated rarity instead of lack of survey effort. However, by being consistent in this application of caution when alternatives were analyzed, we preserved the ability to detect differences in risk to viability among alternatives. Also, the isolation and metapopulation concerns implied by outcomes C, D, and E may be overstated for the 44 bird species that were assigned one of these outcomes. They were assigned to these outcomes because of low abundance and/or patchy distributions, but in general these species are highly mobile and not particularly vulnerable to isolation within a landscape the size of the Forest.

Examining the species' associations with habitats showed which habitats harbor large numbers of species with viability concerns (Figure SV-1). Because all species evaluated in detail have a potential viability concern on the Forest, simply looking at the total number of evaluation species associated with each habitat may be the most straightforward way to gain insight into the relative importance of the habitats for those species. The top ten habitats in terms of total number of species evaluated were bogs, fens, seeps, and seasonal ponds (51 species); rock outcrops and cliffs (38 species); caves and mines (35 species); old riparian forest (30 species); glades and barrens (29 species); woodlands, savannas, and grasslands (29 species); mature riparian forest (29 species); old mesophytic and cove forest (27 species); old northern hardwood forest (26 species); and mature northern hardwood forest (25 species). It is important to note that because most species are associated with more than one habitat, there is some overlap in the number of species associated with the various habitats. For example, many of the 29 species that use mature riparian forest are also among the 30 species associated with old riparian forest. Of these top ten habitats, many are rare and unique habitats that do not cover large areas of the Forest.

Perhaps the most important aspect of species viability evaluation is identifying any species with viability concerns that are likely to be affected by Forest Service management, or lack thereof. A total of 58 species with D or E outcomes are associated with at least one community that is likely to be affected by active or passive Forest vegetation management (Table SV-1). These species occur in a wide variety of communities. A little over half of them (32 species) occur primarily in disturbance-dependent habitats, mostly semi-open oak or pine-oak woodlands, although several are species of open grasslands or openings in boreal forests. The other species occur in a wide variety of mature and old forests; several of them require cool, moist micro-sites. Of these 58 species, three are federally listed, and 22 are listed as RFSS on the Forest. Potential effects to these 25 listed threatened, endangered, and sensitive species currently are considered in Biological Evaluations (BEs) for project-level actions. The remaining 33 species currently are not included in BEs and could be affected by project-level actions. The Species Viability chapter of the AMS recommended that these 33 species be considered for possible inclusion on the RFSS list. Such consideration would not necessarily result in all of them being added to the

RFSS list, but would evaluate the need for protection from typical management activities, as well as the potential for typical conservation measures to mitigate effects.

Figure SV-1.



BF = Bogs, fens, seeps, and seasonal ponds
CH = Stream channels and banks
CM = Caves and mines
GB = Glades and barrens
HF = Hemlock forests
HG = High elevation grasslands
LS = Lakes and ponds
ML = Mixed successional landscapes
MM = Mature mixed mesophytic and cove forests
MN = Mature northern hardwood forests
MO = Mature oak forests
MP = Mature pine-oak forests
MR = Mature riparian forests
MS = Mature spruce forests
OM = Old mixed mesophytic and cove forests
ON = Old northern hardwood forests
OO = Old oak forests
OP = Old pine-oak forests
OR = Old riparian forests
OS = Old spruce forests
OW = Open wetlands
RH = Remote habitats
RO = Rock outcrops and cliffs
SB = Shrub balds
SC = Spray cliffs
WS = Woodlands, savannas, and grasslands
YM = Young mixed mesophytic and cove forests
YN = Young northern hardwood forests
YO = Young oak forests
YP = Young pine-oak forests
YR = Young riparian forests
YS = Young spruce forests

Table SV-1. Species with D or E Viability Outcomes that Occur in One or More Communities that are Likely to be Subject to Active or Passive Vegetation Management

Scientific Name	Common Name	T&E or RFSS	Habitat Associations	Key Habitat Needs
Sorex hoyi winnemana	Southern pigmy shrew		MM, OM, MN, ON, MO, OO	Cool, moist microhabitats
Spilogale putorius	Spotted skunk		RO, MM, OM, MO, OO	Den sites (rock crevices, hollow trees and logs, etc.)
Ammodramus henslowii	Henslow's sparrow		WS	Tall grass habitat in patches > 74 acres
Colinus virginianus	Northern bobwhite		WS, ML	Mixed landscapes of grassland, cropland, brush, and woods
Contopus cooperi	Olive-sided flycatcher		YS, ML, BF	Openings in boreal forests with standing snags
Eremophila alpestris	Horned lark		HG, WS	Mixture of sparse herbaceous vegetation and bare ground
Falco peregrinus	Peregrine falcon	RFSS	RO, RH	Remote cliffs for nest sites
Haliaeetus leucocephalus	Bald eagle	T	MR, OR, LS, CH	Large super-canopy trees for roosting and nesting; good water quality in feeding areas
Lanius ludovicianus	Loggerhead shrike	RFSS	WS	Herbaceous-dominated habitats with scattered trees and shrubs
Limnothlypis swainsonii	Swainson's warbler		OM, MM	Moist cove forests with dense shrubby understory
Lophodytes cucullatus	Hooded merganser		CH, MR, OR	Snags/den trees for nesting; good water quality in feeding areas
Melanerpes erythrocephalus	Red-headed woodpecker		OO, OP, WS	Open oak woods with large trees and snags
Pandion haliaetus	Osprey		MR, OR, LS	Snags or platforms for nesting; good water quality in feeding areas
Petrochelidon pyrrhonota	Cliff swallow		ML, YR, WS	Nest sites on cliffs, bridges, dams, buildings, etc.; open situations for foraging
Pooecetes gramineus	Vesper sparrow		HG, WS	Grasslands > 30 acres
Riparia riparia	Bank swallow		CH, WS, BF, OW	Dirt or gravel banks for nesting; open situations for foraging
Sphyrapicus varius	Yellow-bellied sapsucker		YN, MN, YS, MS	Snags for nesting
Tyto alba	Barn owl		WS	Snags and old buildings for nesting; grassland for foraging
Vermivora ruficapilla	Nashville warbler		BF, YS, ML	Shrubby openings in boreal forests
Plethodon nettingi	Cheat Mountain salamander	T	MS, OS	Moist spruce forests with downed logs and/or flat rocks
Glyptemys insculpta	Wood turtle		MR, OR	Riparian areas with sandy stream banks
Heterodon platirhinos	Eastern hog-nosed snake		YO, MO, YP, MP, WS, ML	Sandy soils in openings or open woodlands
Brachionycha borealis	Boreal fan moth		YO, MO, OO, YP, MP, OP, WS	Oak and pine-oak forests and woodlands with blueberries
Calephelis borealis	Northern metalmark		CH, GB, WS	Forest openings containing squawweed
Cicindela patruela	Barrens tiger beetle	RFSS	GB, RO, WS	Bare ground with sand, gravel, or eroding sandstone within open woodlands
Cicindela purpurea	Tiger beetle		GB, YO, YP	Barrens and open woodlands
Cicindela unipunctata	Tiger beetle		MO, OO, MP, OP, WS	Oak and pine-oak forests and woodlands
Erynnis lucilius	Columbine duskywing		BF, GB, RO, YM	Open areas containing columbine
Hadena ectypa	Noctuid moth		MN, ON	Northern hardwoods with high concentrations of starry campion
Hesperia metea	Cobweb skipper		GB, YO, YP, WS	Dry, grassy openings containing bluestem or broomsedge

Scientific Name	Common Name	T&E or RFSS	Habitat Associations	Key Habitat Needs
Polygonia faunus smythi	Smyth's green comma		BF, MS, OS, MN, ON	Small openings in spruce or northern hardwoods
Speyeria diana	Diana fritillary	RFSS	OM	Mesic forests with dense midstory and small openings
Abies fraseri	Fraser fir	RFSS	YS, MS, OS	Southern Appalachian boreal forests – not native to West Virginia
Agrostis mertensii	Arctic bentgrass	RFSS	RO, HG, YR	High elevation openings
Baptisia australis var. australis	Blue wild indigo		CH, YM, YN, YR	Moist early successional habitats
Botrychium lanceolatum var. angustisegmentum	Lance-leaf grape fern	RFSS	MM, OM, MN, ON	Moist forests
Botrychium oneidense	Blunt-lobe grape fern	RFSS	OM, MM, ON, MN, BF	Moist to wet microsites within northern hardwoods or mesophytic forests
Cornus rugosa	Roundleaf dogwood		RO, GB, ON	Rocky areas within forests
Cypripedium parviflorum var. parviflorum	Small yellow lady's slipper		BF, OM	Moist to wet sites in late-successional forests
Delphinium exaltatum	Tall larkspur	RFSS	GB, WS	Woodlands and barrens on dry, rocky, calcareous soils
Euphorbia purpurea	Darlington's spurge	RFSS	BF, HG, MR, OR	Wet areas; pastures underlain by limestone
Gymnocarpium appalachianum	Appalachian oak fern	RFSS	ON, MN	Cool, moist, shaded microclimates with exposed rock and boulders. Almost always growing on or near moss-covered logs and rocks.
Hasteola suaveolens	False Indian-plantain	RFSS	CH, YR, MR, OR	Flood scour zones
Hexalectris spicata var. spicata	Crested coral root	RFSS	MO, OO, GB	Dry glade woodlands and margins of limestone barrens.
Hypericum mitchellianum	Blue Ridge St. John's-wort	RFSS	HG, BF, MS, OS, MN, ON	Seeps and moist banks, occasionally on rock outcrops, at high elevations.
Isotria medeoloides	Small whorled pogonia	T	MM, OM, MO, OO, MP, OP	Dry oak and oak-pine forests.
Juglans cinerea	Butternut	RFSS	YM, MM, OM, MR, OR	Mesic forests; requires openings for establishment
Juncus filiformis	Thread rush	RFSS	BF, YR, MR, OR, OW	High elevation wet areas
Juncus trifidus	Highland rush	RFSS	RO, HG	Rock crevices and meadows at high elevations
Paxistima canbyi	Canby's mountain-lover	RFSS	RO, MO, OO	limestone cliffs; limestone ledges in open forests under white cedar or hemlocks
Phlox buckleyi	Sword-leaved phlox	RFSS	GB, MO, OO	Shaley slopes in open woods
Piptatherum canadense	Canada mountain ricegrass	RFSS	RO, WS	Dry, semi-open habitats
Rhamnus lanceolata ssp. lanceolata	Lance-leaved buckthorn		GB, WS	Semi-open habitats on limestone or dolomite; shale barrens
Scutellaria saxatilis	Rock skullcap	RFSS	MM, OM, MN, ON	Moist, rocky microhabitats in northern hardwoods and mixed mesophytic forests
Taxus canadensis	American yew		BF, MS, OS, MN, ON	Cool, moist, climax conditions in high-elevation forests and bogs
Trichostema setaceum	Narrow-leaved blue-curls		GB, WS, YO, MO, OO	Shale barrens; sandstone woodlands and glades, and dry oak forests
Triphora trianthophora	Nodding pogonia	RFSS	MM, OM	Rich humus in moist woods with filtered sunlight
Cetraria arenaria	Foliose lichen		YO, OO	Semi-open, fire-maintained oak forests/woodlands

BF = Bogs, fens, seeps, and seasonal ponds MO = Mature oak forests

CH = Stream channels and banks
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Effect Determinations for Regional Forester's Sensitive Species

The 2004 Threatened and Endangered Species Amendment to the Forest Plan evaluated effects of the 1986 Forest Plan on RFSS. The BE for this amendment concluded that the 1986 Forest Plan, as amended, would have both beneficial and minor negative impacts on various RFSS (USDA Forest Service 2003b). For all RFSS, the BE reached a determination of "may impact individuals; not likely to lead to loss of viability or a trend towards federal listing." The rationale for these determinations was that because of the Forest's need to balance benefits derived from management of the Forest, some minor impacts to RFSS may occur. However, it is the policy of the Forest and the agency to avoid or minimize such impacts to the extent possible, and mitigate unavoidable impacts such that viability is maintained for all species. The BE for the 2004 Threatened and Endangered Species Amendment contains more detailed discussions of potential effects on RFSS associated with particular habitat groups (USDA Forest Service 2003b).

ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Laws, Regulations, and Policies

Numerous laws, regulations, and policies govern the management of species diversity and viability on NFS lands. National laws and regulations have also been interpreted for implementation in the Forest Service Manual and Handbook. Some of the more influential laws, regulations, and policies governing species diversity and viability are listed in Table SV-2.

Table SV-2. Major Laws, Policies, and Regulations Influencing Management of Species Viability on NFS Land

Act/Law/Regulation/Policy	Law/CFR/FSM/FSH Number
Migratory Bird Treaty Act	16 U.S.C. 703-712
Fish and Wildlife Coordination Act	16 U.S.C. 661-667e
Multiple Use-Sustained Yield Act	16 U.S.C. 528-531
Sikes Act	16 U.S.C. 670a-670o
Endangered Species Act	16 U.S.C. 1531-1544
National Forest Management Act	16 U.S.C. 1600-1614
Fish and Wildlife Conservation Act	16 U.S.C. 2901-2911
Federal Cave Resources Protection Act	16 U.S.C. 4301-4310
NFMA implementing regulations regarding wildlife, diversity, viable populations, threatened and endangered species, and habitat management	36 CFR 219.19; 219.26; 219.27(a)(5), (a)(6), (a)(8), (b)(6), (g)
Directives for Habitat Planning and Evaluation	FSM 2620
Directives for Management of Fish and Wildlife Habitat	FSM 2630
Directives for Threatened, Endangered, and Sensitive Species	FSM 2670
Directives for Cave Management	R9 Supplement to FSM 2350

Forest Plan Direction and Implementation

Forest Plan direction for the protection of species diversity and viability occurs primarily at the Forest-wide level. Forest-wide direction emphasizes protection, maintenance, and enhancement of habitat for threatened, endangered, proposed, and RFSS species. Direction calls for avoiding and minimizing negative impacts to the extent possible, and mitigating any unavoidable negative effects. While the general emphasis of the existing and revised Forest-wide direction is very similar, the revised direction contains more specific goals and objectives for identifying and implementing habitat enhancement and restoration opportunities for RFSS. Also, the 2006 Forest Plan direction includes similar goals, objectives, standards and guidelines for Migratory Birds of Conservation Concern, which were not a management issue when the 1986 Forest Plan's direction was written.

Effects Common to All Alternatives

Many Forest management activities have at least some potential to affect individuals and habitat for RFSS and other species with potential viability concerns. NFMA regulations require maintenance of viable populations. In addition, Forest Service Manual direction requires that management actions not cause trends toward federal listing, and Forest Plan direction emphasizes avoiding, minimizing, and mitigating any negative effects on RFSS. Because of these requirements, management activities will be carefully evaluated for any potential negative effects on RFSS or species viability. Therefore, no activities are expected to result in loss of viability or a trend toward federal listing for any species. The effects discussed below indicate where viability risks may increase or decrease, but in all cases the effects attributable to Forest management are expected to remain below the threshold where loss of viability or a trend toward federal listing occurs.

Mineral Exploration, Development, and Leasing

Natural gas leasing is the most common form of mineral development on the Forest. In any given area subject to gas development, typically only a small percentage of the habitat is affected. Usually the maximum surface disturbance associated with each gas well is about 15.5 acres. This includes about 2 acres for the well site, 2 acres for access roads, and 11.5 acres of pipelines. Pipelines are approximately 15 to 40 feet wide, and monitoring on the Forest has shown that the tree canopy usually closes over the pipeline within three to five years. Thus the long-term effects of each gas well amount to the conversion of about 4 acres of forested habitat to non-forested habitat. The maximum density of gas wells in most areas is about one well per 640 acres. Therefore, the long-term effects to major forested communities are estimated to include the conversion of less than 1 percent of the forested habitat in a given area to non-forested habitat. Loss of such small percentages of habitat is not expected to appreciably affect viability outcomes for species with potential viability concerns. For RFSS, individuals may be impacted, but population effects sufficient to cause a loss of viability or trend toward federal listing are unlikely. Direction in the Forest Service Manual and the Forest Plan require that unavoidable negative effects on RFSS be mitigated such that loss of viability and trends toward federal listing do not occur.

Other forms of mineral development are currently rare on the Forest, but could occur. Potential effects could vary widely depending on the degree of surface disturbance. Certain activities such as surface mining could have locally intense effects on habitat and could affect individuals, but such intense effects are not likely to occur over large areas. Because of their localized nature, effects from mineral development are not likely to substantially affect viability outcomes. For RFSS, individuals may be impacted, but loss of viability and trends toward federal listing are not expected.

Vegetation/Timber Management – Mechanical Treatments

Mechanical vegetation treatment is the main tool used to manage plant and animal habitats on the Forest. Vegetation management will occur over broad areas and has the potential to substantially modify the age class distribution and composition of some forested communities. Therefore, vegetation management could affect viability outcomes and effects to RFSS for some species. Such effects will not be uniform across all alternatives for all species, therefore effects of vegetation management on viability outcomes are covered below under Direct and Indirect Effects by Alternative.

Vegetation/Timber Management – Salvage Harvest

Salvage harvesting has the potential to change habitat amounts and characteristics for RFSS and species with potential viability concerns. The effects of the change, as well as whether the effects are viewed as positive or negative, vary among species. The extent and magnitude of potential effects due to salvage harvesting are impossible to predict because the natural disturbances that trigger salvage harvesting are not predictable. However, requirements to maintain viability and Forest Plan direction to mitigate negative effects would prevent loss of viability and trends toward federal listing.

Range Management – Livestock Grazing

Acreage devoted to range allotments has been declining slowly over several decades, and the revised Forest-wide management direction calls for maintenance of existing grazing capacity. Based on current trends and the revised management direction emphasis, new allotments likely would be limited to newly acquired lands that contain pastures. Given that current range allotments cover less than 7,000 acres and the trend in range acreage is expected to be flat to declining, active range management is not likely to substantially affect viability outcomes or RFSS. If the decline in range acreage continues, the replacement of open land with forest could increase viability risks for some species that require open, grassy habitat. However, the vast majority of such habitat in the Forest boundary occurs on private land, so any effects due to decline of range acreage on NFS lands are likely to be minor. Because the amount of range land that might revert to forest is tiny compared to existing forests, any positive effects on viability of forest species would not be measurable.

Fire Management – Fire Suppression

Fire suppression prevents intense wildfires from converting mature and old forests to openings and young forests, potentially preventing increased risk to viability for species associated with mature forests. Fire suppression in fire-adapted landscapes can cause degradation or loss of fire-maintained communities, thereby increasing viability risk for species associated with such habitats. Fire suppression activities (e.g., fire lines) can also cause localized direct impacts to habitats and individuals. However, because such impacts usually are limited to small areas, they are not expected to substantially increase viability risks, unless they happen to damage an occurrence of a species that is very rare on the Forest. Because of requirements to maintain viability and Forest Plan direction to mitigate negative effects to RFSS, fire suppression is not expected to cause loss of viability and trends toward federal listing.

Fire Management – Prescribed Fire Use

Prescribed fire in fire-adapted communities maintains natural habitat structure and composition, thereby reducing viability risks for species associated with such communities. Prescribed fire in fire-sensitive communities can degrade or destroy natural habitat structure and composition, which can increase viability risks for species that inhabit those communities. However, Forest Plan goals and objectives do not encourage prescribed burning in fire-sensitive communities, so widespread effects on such habitats are unlikely. Prescribed fire also presents a risk of direct mortality to rare plants or animals that cannot escape the fire. However, the presence of such species is one of the factors considered in planning prescribed fire. Because of requirements to maintain viability and direction in the Forest Plan to avoid and mitigate negative effects, any increases in viability risk due to prescribed fire are expected to be minor and would not cause a loss of viability or trend toward federal listing.

Roads – Construction, Reconstruction, Maintenance, and Decommissioning

Road construction and reconstruction converts small amounts of forested habitat to non-habitat, and creates edges and fragmentation in surrounding forest. These habitat changes can cause minor increases in viability risk for species that require unbroken forest. However, such habitat changes can reduce viability risk for forest species that require scattered canopy gaps or openings. Road construction and reconstruction in semi-primitive non-motorized areas can increase viability risk for species that require remote habitat. Road construction and reconstruction can create disturbed habitat along road shoulders and cut/fill slopes, possibly reducing viability risks for species that use disturbed habitats. Also, road construction and reconstruction provide access necessary for managing disturbance-dependent habitats, thereby reducing viability risks for species associated with those habitats.

Road maintenance perpetuates the habitat changes caused by road construction. Because it prevents re-colonization of road beds by forests, it maintains viability risks caused by roads for species that require unbroken forest. Road maintenance prevents reversion to semi-primitive non-motorized conditions, thereby sustaining existing viability risks to species that require remote habitats. However, road maintenance can prevent increases in viability risk for species that use canopy gaps and disturbed areas along roads. Road maintenance preserves access for habitat management, which prevents increased viability risk to species associated with disturbed habitats that must be maintained through active management.

Road decommissioning restores forested habitat that was previously reduced and fragmented by road construction. Therefore, road decommissioning can reduce viability risks to forest interior species. Where road decommissioning creates semi-primitive non-motorized areas, viability risks to species requiring remote habitat can be reduced. Over the long term, road decommissioning eliminates canopy gaps and disturbed habitats associated with roads, therefore it can increase viability risk for species associated with such habitats. Road decommissioning can also eliminate access necessary for managing disturbance-dependent habitats, which can increase viability risks for species associated with those habitats.

Recreation – Developed Recreation

Depending on the intensity of developed recreation activities, the associated facilities can have effects ranging from minor alteration of habitat (e.g., a small picnic area) to replacement of habitat with structures and maintained landscaping (e.g., a visitor center). Effects on viability risks at the low end of the intensity scale are expected to be negligible. Activities at the high end of the intensity scale have the potential to remove habitat for species with viability concerns, but the developments typically occupy small, localized areas. Therefore, they generally can be located such that they avoid substantial impacts to habitat for RFSS and other species with viability concerns. Developed facilities could create small areas of habitat for species with viability concerns that require disturbed habitats.

Recreation – Dispersed Recreation

Habitat changes associated with dispersed recreation generally are so minor that they are not expected to have measurable effects on viability risks. However, more noticeable effects on habitat could occur in and around areas that are subject to localized heavy use. Such use could increase viability risk to the extent that it occurs in habitats occupied by RFSS or other species with viability concerns. Efforts to avoid and mitigate negative effects to RFSS should relocate damaging recreational use, thereby limiting any increased risk to viability.

Recreation – Motorized Recreation Use

Effects associated with motorized recreation are largely due to the roads that are necessary to facilitate motorized access. These effects are discussed above in the Roads subsection. Because roads are rarely constructed solely for motorized recreational use, motorized recreation is likely to occur on roads that would have been constructed anyway for management access reasons. Therefore, effects of roads used for motorized recreation would not be additive to the road effects already discussed.

However, off-road motorized use could have additional effects on viability risks. The Forest does not allow off-road motorized vehicle use except on designated routes. Currently there are no designated routes, so authorized off-road motorized recreation would require construction of a dedicated trail system to accommodate off-road vehicles. The effects of constructing and maintaining such a system would be similar to the effects of road construction and maintenance, but the effects would be in addition to the effects of roads that are constructed for management access. However, per mile of trail, effects would be less extensive than road construction effects because off-road vehicles generally do not require trails as wide as most roads. Although no plan alternative contains specific goals, objectives, or limitations regarding the amount of off-road vehicle trails to be constructed, it is considered unlikely that the Forest would construct enough off-road vehicle trails to measurably affect viability for any species.

Soil, Water, Riparian, Aquatic – Active Restoration

Active soil, water, riparian, and aquatic restoration typically is conducted on very localized sites. Therefore, it is likely that such activities would be designed to completely avoid adverse impacts to individuals and habitat for RFSS and other species with viability concerns. To the extent that habitat for RFSS and viability concern species is restored, viability risks could be reduced. However, restoration that reforests disturbed areas could increase viability risk for species associated with disturbed habitat. Because active restoration is likely to affect only small, localized areas, it is unlikely that such restoration of disturbed areas would cause substantial viability risk.

Soil, Water, Riparian, Aquatic – Passive Restoration

Effects of passive soil, water, riparian, and aquatic restoration would be similar to those discussed above for active restoration.

Wildlife/Fish Habitat Restoration

Traditional maintained wildlife openings convert forested habitat to non-forest habitat and contribute to fragmentation of remaining forested habitat. These activities could cause a small increase in viability risk for species that require forest interior habitat. However, wildlife openings generally would be designed to avoid negative impacts to occurrences of RFSS and species with viability concerns. Wildlife openings could reduce viability risks for species that need open, herbaceous habitats.

Habitat restoration for species that require forested habitat could reduce viability risks for forest interior species. If such restoration involves reforesting open areas, it could increase risk for species that require herbaceous openings or other disturbed habitats. However, such restoration projects generally would be designed to avoid negative effects to occurrences of RFSS and other species with viability concern.

Direct and Indirect Effects by Alternative

Distribution of Viability Outcomes

Projected viability outcomes under all alternatives showed little change from current conditions (Table SV-3). Each of the alternatives had 188 species with viability outcomes of C, D, or E, indicating low abundance and some degree of risk to viability. This is a net decrease of one species from the 189 species with C, D, or E outcomes under existing conditions. Considering just the higher-risk D and E outcomes, Alternatives 1 and 3 each had 128 species with these outcomes, whereas Alternatives 2, 2M, and 4 each had 127 species. These results show a slight projected improvement from the 129 species that currently have D or E outcomes. Compared to current conditions, Alternatives 1 and 3 each had three species with decreased risk to viability and one species with increased risk to viability, while Alternatives 2, 2M, and 4 each had four species with decreased risk and one species with increased risk. Viability outcomes for all species evaluated in detail are contained in Appendix D. Data forms displaying the ratings and rationale that formed the basis for the outcomes are contained in the project record and are incorporated by reference.

Table SV-3. Viability Outcomes by Alternative and Comparison to Current Outcomes

Outcome	Number of Species With the Specified Outcome					
	Current	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
A	3	3	3	3	3	3
B	17	18	18	18	18	18
C	60	60	61	61	60	61
D	71	71	70	70	71	70
E	58	57	57	57	57	57
Insufficient Information	10	10	10	10	10	10
Number of species with decreased risk relative to current	--	3	4	4	3	4
Number of species with increased risk relative to current	--	1	1	1	1	1

Five species had projected viability outcomes under one or more alternatives that differed from outcomes based on current conditions (Table SV-4). Information from the viability data forms for these species is summarized below.

Black-Billed Cuckoo – The black-billed cuckoo (*Coccyzus erythropthalmus*) is a bird that breeds in deciduous forest areas of the northeastern United States and southern Canada, as well as riparian areas and shrubby habitats in the Great Plains (NatureServe 2003). It migrates to South America for the winter. In the Appalachians, this species prefers a dense understory and midstory characteristic of old forests undergoing gap-phase regeneration, but it is also known to use anthropogenic forest gaps (NatureServe 2002).

For this evaluation, the black-billed cuckoo was assigned to the old stages (stand age 120+ years) of mixed mesophytic and cove forest, northern hardwood forest, and oak forest. Currently, old stands are uncommon on the Forest, but old forest alone probably underestimated habitat for this species because it did not account for use of mature (40-119 years old) forest with a dense understory and midstory due to anthropogenic disturbance or other factors. However, information was not available to identify the portion of mature forest that provides habitat, and using all mature forest likely would have greatly overestimated habitat for this species. Therefore, habitat abundance for the current condition was rated as occasional as a compromise between the relative rarity of old forest and the species' ability to use disturbed areas and edges in mature stands. Habitat distribution was rated as connected because of the species' high mobility, and because potential habitat is scattered throughout the Forest within a forested landscape matrix.

Population factors for the current condition were rated as moderate risk. *The West Virginia Breeding Bird Atlas* (Buckelew and Hall 1994) and breeding bird point count data compiled by the West Virginia Division of Natural Resources (WVDNR unpublished data 2003) showed that the species is known to occur across the northern and southern ends of the Forest, with no records known from potential habitat in the central part of the Forest. The apparent gap in the distribution could be because surveys missed occupied habitat, or it could indicate that an unidentified population factor is preventing the species from occupying habitats in that area. Breeding Bird Survey data from 1980 to 2002 (Sauer et al. 2003) showed declining population trends in the central Appalachians and continent-wide.

By the later decades of the planning horizon, old hardwood forest habitat on NFS land is projected to increase at least fifteen-fold under all alternatives. While precise estimation is not possible for the future cumulative amount of habitat on all land ownerships within the Forest boundary, the current trend on private land is toward an increase in large-diameter trees (data from USDA Forest Service Forest Inventory and Analysis website 2004), which presumably means an aging forest. Should this trend continue, the cumulative effect of this trend combined with the large increase on NFS land would cause a large increase in total habitat within the Forest boundary. The habitat is projected to be so abundant on NFS land that it would cover a quarter to a third of all land in the Forest boundary even if no habitat were present on private land. Therefore, the habitat abundance rating for black-billed cuckoo was upgraded to common under all alternatives. Because habitat would be common and connected, the viability outcome was upgraded from C to B under all alternatives. Outcome A was not chosen because lack of information did not allow upgrading the moderate risk rating for population factors.

Yellow-Breasted Chat – The yellow-breasted chat (*Icteria virens*) is a bird that breeds in shrub-sapling habitats with little or no tree canopy across much of the continental United States and northern Mexico. It migrates to Central America for the winter. The chat does not occur in gaps in mature and old forest; a breeding population requires a patch of shrubby habitat 12 acres or larger (NatureServe 2003).

The yellow-breasted chat was assigned to the young stages (0-39 years) of mixed mesophytic and cove forest, oak forest, pine-oak forest, and riparian forest. This probably overestimated habitat somewhat because it includes pole-sized stands that do not provide habitat suitable for this species. The identified potential habitat covers about 6 percent of NFS land and about 6 percent of all land in the Forest boundary. Habitat abundance was rated occasional for the current condition. Habitat distribution was rated connected because the chat is a highly mobile long-distance migrant, and it specializes in exploiting patchy, ephemeral habitats (NatureServe 2003).

Current condition population factors were rated moderate risk. The *West Virginia Breeding Bird Atlas* (Buckelew and Hall 1994) documented possible, probable, or confirmed breeding in widely scattered locations within the Forest boundary, which may indicate that some potential habitat is unoccupied. Breeding Bird Survey data from 1980 to 2002 showed a population decline of 2.2% per year in West Virginia (Sauer et al. 2003).

During the middle and later decades of the planning horizon, potential habitat on NFS land is projected to increase two- to three-fold under all alternatives. This increase would be due to timber harvesting associated with meeting age class diversity objectives. If the trend toward declining amounts of young forest on private land continues, it would offset some of the habitat gains on NFS land. However, even if no habitat remained on private land, the increase on NFS land would maintain the current cumulative amount of habitat on all land ownerships under Alternative 3, and increase the cumulative amount under the other alternatives. Based on the likelihood that at least some habitat is likely to remain on private land, a cumulative increase in habitat seems likely under all alternatives, and habitat abundance for all alternatives was rated common. To reflect the common and connected habitat, the viability outcome was upgraded from C to B for all alternatives. Outcome A was not chosen because of the population factors risk indicated by the Breeding Bird Survey population declines.

Red-Headed Woodpecker – The red-headed woodpecker (*Melanerpes erythrocephalus*) inhabits semi-open forest and woodland habitats throughout much of the eastern two-thirds of the continental United States. It typically does not occur in dense forests. Mast is an important food source for this woodpecker, so it is closely associated with oak-dominated communities. Other important habitat attributes include snags for nest cavities and trees with large dead limbs that provide insects, which are another important dietary component (NatureServe 2003). This species is believed to be a permanent resident in much of its range, including West Virginia, though populations on the northern and western fringes of the range migrate to the southeastern states for the winter (Buckelew and Hall 1994, NatureServe 2003).

For this analysis, potential habitat was considered to be the old stage of oak forest and pine-oak forest, as well as the woodlands, savannas, and grasslands community. These communities probably overestimated habitat because it is likely that much of the old oak and pine-oak forest is unsuitably dense due to decades of fire suppression. Also, the woodlands, savannas, and grasslands community is largely comprised of pasture and hay land, some of which may be too open and lacking in snags. The identified potential habitat covers about 3 percent of NFS land and about 6 percent of all land in the Forest boundary. However, because this was considered to be an overestimate of suitable habitat, habitat abundance was rated rare for the current condition. Habitat distribution was rated patchy because potential habitat is concentrated in several distinct clusters where oaks or farmland dominate the landscape. Also, the species is known to have high breeding site fidelity (NatureServe 2003) and is believed to be non-migratory in West Virginia, both of which could limit its ability to colonize vacant habitat. However, the species is a highly mobile bird and should be able to disperse to habitats that are in reasonably close proximity to each other; therefore, habitat distribution was not rated isolated.

Population factors for the current condition were rated moderate risk. The West Virginia Breeding Bird Atlas (Buckelew and Hall 1994) and breeding bird point counts (WVDNR unpublished data 2003) found the species in a total of only three locations within the Forest boundary, indicating that much of the identified potential habitat appears to be vacant. Breeding Bird Survey data from 1980 through 2002 showed a continent-wide decline of 4.5 percent per year (Sauer et al. 2003).

Under Alternatives 2, 2M, and 4, potential habitat on NFS land in the middle and later decades of the planning horizon would increase about five- to six-fold over the current condition. Most of this increase would be due to aging of oak and pine-oak stands into the old stage, though a small part of the increase would be due to projected increases in wildlife openings and savannas, which are included in the woodlands, savannas, and grasslands community. Unlike the current condition, much of the potential habitat would be suitable if goals and objectives for prescribed burning are met. Alternatives 2 and 2M would raise the limit on prescribed fire from the current 300 acres per year to 30,000 acres per decade (average of 3,000 acres per year). Alternative 4 would allow an average of 7,500 acres of prescribed fire per year and would seek to treat all high priority areas in need of prescribed fire on a 29-year cycle. Such increases in prescribed fire, if achieved, would mean that under Alternatives 2 and 2M, about half of the potential habitat on NFS land likely would be suitable for red-headed woodpeckers. Under Alternative 4, a large majority of the identified potential habitat likely would be suitable. The cumulative amount of habitat on all land ownerships in the Forest boundary is difficult to predict, but given that a large, coordinated prescribed burning program is unlikely to occur on private land, it is likely that the private land contribution to habitat would not increase. However, even if no habitat were available on private land, the increase in habitat on NFS land would still increase the cumulative habitat amount relative to the current condition. Due to the large projected increase in habitat amount on NFS land, habitat abundance under Alternatives 2, 2M, and 4 was rated occasional. Habitat abundance was not rated common because of the assumed scarcity of habitat on private land. Because the current patchy distribution of habitat is largely related to topographic factors that influence tree species composition, the patchy habitat distribution rating was retained, even though some local-scale improvement in connectivity likely would occur in conjunction with the large increase in habitat amount. Because of the large increase in habitat, viability outcomes under Alternatives 2, 2M, and 4 were upgraded from D to C. Outcome B was not chosen due to the possible population risks implied by the Breeding Bird Survey decline and the current sparse distribution within potential habitat.

Under Alternatives 1 and 3, potential habitat would increase in magnitude similar to the increases projected for Alternatives 2, 2M, and 4, but the limit on prescribed fire would not increase. Therefore, very little of the potential habitat would actually be suitable. The habitat abundance ratings remained rare under these alternatives, and the current D outcome was maintained.

Mourning Warbler – The mourning warbler (*Oporornis philadelphia*) is a small songbird that breeds in dense woodland thickets and shrubby bogs across southern Canada and the north-central and northeastern United States (NatureServe 2003). A disjunct population breeds in the higher mountains of eastern West Virginia, western Maryland, and western Virginia (NatureServe 2003, National Geographic Society 1999). The mourning warbler migrates to Central and South America for the winter. In West Virginia, the species is limited to high-elevation forests, where it nests in regenerating stands and small wind-throw patches (Buckelew and Hall 1994). The key habitat feature is dense shrubby vegetation.

Potential habitat was identified as the young stages of spruce forest and northern hardwood forests, plus the bogs, fens, seeps, and seasonal ponds community. For the current condition, this habitat was estimated to cover about 2 percent of all NFS land and about 3 percent of all land ownerships in the Forest boundary. These communities may have underestimated suitable habitat because they do not include small gaps in mature stands that could provide habitat. Habitat abundance for the current condition was rated occasional. Habitat distribution was rated connected because the species is a highly mobile long-distance migrant and is adapted to exploiting patchy, ephemeral habitats.

Population factors for the current condition were rated moderate risk. The species occurs in many areas of potential habitat within the Forest boundary, but appears to be rare or absent in apparently suitable habitat on the Allegheny Front (Hall 1983, Buckelew and Hall 1994). Breeding Bird Survey data for 1980 through 2002 showed declines of 2.3 percent per year for eastern North America and 2.4 percent per year continent-wide.

By the middle and later decades of the planning horizon, potential habitat would decline to about 1 percent of all NFS land under Alternatives 1 and 4, and less than 1 percent under Alternatives 2, 2M, and 3. This decline is due to lack of even-aged timber harvest in essentially all spruce forest and most northern hardwood forest. Potential habitat resulting from natural disturbances is not accounted for in these projections, but without even-aged harvesting the amount is likely to decline relative to the current amount. The cumulative amount of habitat on all land ownerships within the Forest boundary is difficult to predict, but if the current trend toward aging forests on private land continues, the cumulative habitat amount is likely to decline as well. Because of this projected decline in habitat amount, the habitat abundance rating was lowered to rare for all alternatives, and the viability outcome was downgraded from B to C for all alternatives.

Diana Fritillary – The Diana fritillary (*Speyeria diana*) is a butterfly whose range is centered on the southern Appalachian mountains. Historically it was known to range as far north as southwestern Pennsylvania, but currently it is not known to occur north of Pocahontas County, West Virginia (NatureServe 2003, Allen 1997). This species requires mesic forest that provides a dense midstory for breeding sites and small openings for feeding on flower nectar. Prior to large-scale industrial logging in the late 19th and early 20th Centuries, such habitat likely was provided by old-growth forests. Large-scale logging of old growth forests is believed to have been responsible for major population declines in the 20th Century. Currently, mature second growth forests with small natural or anthropogenic openings provide habitat (NatureServe 2003, NatureServe 2002).

The current habitat amount was difficult to estimate because the species has an affinity for old-growth forests, but is also able to use mature forests with scattered openings. Old mixed mesophytic and cove forest covers only about 0.5 percent of NFS land and about 0.5 percent of all land ownerships in the Forest boundary. In contrast, mature mixed mesophytic and cove forest covers about 35 percent of all NFS land and about 32 percent of all land in the Forest boundary. Habitat abundance was rated occasional as a compromise estimate between these two extremes. Because the specific areas that provide habitat within mature forests could not be identified, habitat distribution could not be evaluated accurately enough to develop a current conditions rating.

Population factors were rated high risk for the current condition. West Virginia Natural Heritage Program records (unpublished data) show only two occurrences for Diana fritillary within the Forest boundary, both near the southern end of the Forest. Based on these records, most of the potential habitat on the Forest appears to be vacant. Pesticide spraying for gypsy moth control is believed to be a major threat to the recovery of Diana fritillary populations (NatureServe 2003). Because of the apparent high risk to populations, the species was assigned a current conditions viability outcome of E.

During the middle and later decades of the planning horizon, old mesophytic and cove forest would increase more than 30-fold under all alternatives. Because much of this old forest would be beginning gap-phase regeneration, most of it is expected to provide suitable habitat. Potential habitat for the Diana fritillary would cover 20 to 25 percent of all NFS land. The cumulative amount of habitat on all land ownerships in the Forest boundary is difficult to predict, but if the current trend toward aging forests on private land continues, the cumulative habitat amount would increase also. Even if no habitat existed on private land, the increase on NFS land would raise the cumulative habitat amount to 12 to 13 percent of all land in the Forest boundary. Because of the large projected increase in habitat, the habitat abundance rating was raised to common for all alternatives. Also, because old mixed mesophytic and cove forest would form one of the dominant landscape matrix communities, habitat distribution was rated connected for all alternatives. Based on common and connected habitat, the viability outcome was upgraded to C for all alternatives. Outcomes A and B were not chosen because of uncertainty over the future threat posed by spraying for gypsy moth, and uncertainty over the species' ability to re-colonize areas from which it has been extirpated.

Table SV-4. Species with Projected Viability Outcomes that Differed from Current Conditions

Species	Viability Outcome					
	Current Condition	Alt.1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Birds						
Black-billed cuckoo	C	B	B	B	B	B
Yellow-breasted chat	C	B	B	B	B	B
Red-headed woodpecker	D	D	C	C	D	C
Mourning warbler	B	C	C	C	C	C
Invertebrates						
Diana fritillary[1]	E	C	C	C	C	C

[1]Regional Forester's Sensitive Species.

Species With Habitat Abundance Rating Differences – Eleven species had a habitat abundance rating under one or more alternatives that differed from the current condition, but a viability outcome that remained the same as the current condition across all alternatives (Table SV-5). Generally, this was because the outcome was driven by the population factors or habitat distribution ratings. While risk to viability for these species is not expected to change appreciably from current conditions based on available information, unforeseen changes in the conditions that drove the population factors or habitat distribution ratings could enable changes in habitat abundance to exert more influence over risks to viability.

Habitat abundance ratings for these species differed from existing conditions for varied reasons. The Allegheny woodrat (*Neotoma magister*) uses oak mast for a food source. Its habitat abundance rating was downgraded from occasional to rare under all alternatives because of the projected decline in the amount of oak and pine-oak forest in the optimum mast-producing age range. The northern goshawk (*Accipiter gentilis*) is believed to rely on remote forests. Therefore, its habitat rating was upgraded from rare to occasional under Alternative 3 because of that alternative's strong emphasis on remote backcountry. The whip-poor-will (*Caprimulgus vociferus*) relies on the young and mature stages of oak and pine-oak forest. Because the mature stage is expected to decline substantially as stands reach the old stage, habitat abundance for this species was downgraded from common to occasional under all alternatives. The yellow-bellied sapsucker (*Sphyrapicus varius*), brown-lined dart moth (*Anaplectoides brunneomedia*), and Atlantis fritillary (*Speyeria atlantis*) all depend on young or mature spruce and northern hardwood forests to meet at least part of their habitat requirements. Because of the projected lack of even-aged management in these communities, habitat abundance for these species was downgraded under four or more alternatives. The black vulture (*Coragyps atratus*), worm eating warbler (*Helmitheros vermivorus*), small yellow lady's slipper (*Cypripedium parviflorum* var. *parviflorum*), and foliose lichen (*Cetraria arenaria*) all depend on old forests for part or all of their habitat requirements. Because old forests would increase substantially under all alternatives, habitat abundance ratings for these species have been upgraded under all alternatives.

Table SV-5. Species Whose Habitat Abundance Ratings under One or More Alternatives Differed from the Current Condition, but Whose Viability Outcome Did Not Change from the Current Condition

Species	Habitat Abundance Rating						Viability Outcome – All Alternatives
	Existing Condition	Alternative 1	Alternative 2	Alternative 2M	Alternative 3	Alternative 4	
Mammals							
Allegheny woodrat[1]	Occasional	Rare	Rare	Rare	Rare	Rare	C
Birds							
Northern goshawk[1]	Rare	Rare	Rare	Rare	Occasional	Rare	C
Whip-poor-will	Common	Occasional	Occasional	Occasional	Occasional	Occasional	B
Black vulture	Rare	Occasional	Occasional	Occasional	Occasional	Occasional	C
Worm-eating warbler	Occasional	Common	Common	Common	Common	Common	B
Yellow-bellied sapsucker	Common	Rare	Rare	Rare	Rare	Rare	D
Invertebrates							
Brown-lined dart moth	Occasional	Rare	Rare	Rare	Rare	Rare	C
Early hairstreak	Common	Occasional	Occasional	Occasional	Occasional	Occasional	C
Atlantis fritillary	Occasional	Occasional	Rare	Rare	Rare	Rare	C
Vascular Plants							
Small yellow lady's slipper	Rare	Occasional	Occasional	Occasional	Occasional	Occasional	D
Non-vascular plants							
Foliose lichen	Occasional	Common	Common	Common	Common	Common	D

[1]Regional Forester's Sensitive Species.

Effect Determinations for Regional Forester's Sensitive Species

Currently there are 83 terrestrial species that are listed as RFSS on the Forest. All of these RFSS were assessed individually as part of the species viability evaluation, and viability outcomes were assigned. Viability outcomes for RFSS are contained in Appendix D. Table SV-6 summarizes viability outcomes by alternative for RFSS.

Viability outcomes for RFSS showed no differences among alternatives, and only one RFSS had a viability outcome under the alternatives that differed from the existing condition. The assigned outcome for this species, Diana fritillary, improved from E under the existing condition to C under all alternatives. Reasons for this change are discussed above.

A large number of RFSS were assigned viability outcomes of D or E, indicating very low abundance and possible fragmentation/isolation problems. About three-quarters of these occur in naturally rare habitats such as wetlands or caves. The rarity of such species generally is not attributable to past or current management activity, although management activity has the potential to impact these species if the species' habitat is affected. However, Forest Plan direction generally protects most rare habitats. Most of the remaining D and E outcome RFSS are sensitive due to a limited distribution within potential habitat. For most of these species, the reasons for the limited distribution are not well-known. Because these species are not necessarily limited to protected rare habitats, management activity has a higher likelihood of affecting potential habitat for these species.

Table SV-6. Summary of Viability Outcomes for RFSS

Viability Outcome	Number of RFSS With Outcome Shown					
	Existing Condition	Alternative 1	Alternative 2	Alternative 2M	Alternative 3	Alternative 4
A	0	0	0	0	0	0
B	2	2	2	2	2	2
C	13	14	14	14	14	14
D	26	26	26	26	26	26
E	41	40	40	40	40	40
Insufficient Information	1	1	1	1	1	1

The species viability evaluation considered broad-scale risks to viability of RFSS and other species based primarily on an assessment of each alternative's potential to affect the amount and distribution of potential habitat. A more detailed analysis of potential effects to RFSS and occupied habitat is not possible at the Forest Plan level because of the programmatic nature of the plan. The plan does not propose or authorize any specific actions, so site-specific effects cannot be evaluated. Because no potential management action can be completely ruled out at the Forest Plan level, the potential for adverse or beneficial effects to any RFSS would exist under each of the plan alternatives. The potential for adverse effects is small due to Manual and Plan direction that requires assessment of possible effects to RFSS, avoidance of effects where possible, mitigation of unavoidable effects, and avoidance of any loss of viability or trend toward federal listing. Therefore, for all RFSS, we have determined that each alternative is not likely to cause a trend toward federal listing or a loss of viability.

Cumulative Effects

Distribution of Viability Outcomes

The viability outcomes presented above apply to each species' range within the Forest boundary (proclamation boundary and purchase units). Because species do not recognize land ownership boundaries, the viability outcomes were developed by considering all habitats, occurrences, activities, and threats within the Forest boundary, regardless of land ownership. It was assumed that activities and threats adjacent to the boundary would be similar in effect. The viability outcomes also were developed considering changes in habitat amount and distribution that have occurred from presettlement to present, and also considering the best possible projections of future changes due to activities on all land ownerships within the analysis area. Therefore, these outcomes represent an integrated assessment of the direct and indirect effects of National Forest management under the plan alternatives, and the cumulative effects of past, present, and reasonably foreseeable future actions on all land within the analysis area. The project record contains viability data forms that document for each species analyzed the consideration of direct and indirect effects of Forest Service actions, as well as the cumulative effects of other appropriate past, present, and reasonably foreseeable future actions within this area.

Effect Determinations for Regional Forester's Sensitive Species

Effect determinations for RFSS were made considering each species' current habitat, threats, and occurrences within the analysis area, as well as the potential for Forest Service management to affect individuals and habitat. Activities that occur on other land ownerships within and adjacent to the Forest have the potential to affect the overall habitat-occurrence-threat context within which effects of Forest Service management are considered. Such reasonably foreseeable activities include, but are not limited to, timber harvest, residential development, mining, oil and gas development, livestock grazing, row-crop agriculture, and highway construction. Typically these activities have the potential for mostly negative impacts on RFSS and their habitat, though some disturbance-dependent species could be benefited by some of these activities. Current levels of these activities suggest that, when combined with projected Forest Service management, cumulative effects sufficient to change RFSS effect determinations are not likely to occur. However, the future extent and intensity of such activities is difficult to predict. If they affect large areas of habitat or jeopardize important occurrences for a particular species, the cumulative effects of these activities combined with Forest Service activities could downgrade the effect determination. If this occurs, Forest Service management activities may have to be reviewed to ensure that cumulative effects do not cause loss of viability or trends toward federal listing.

Terrestrial Management Indicator Species and Other Species of Interest

INTRODUCTION

Management Indicator Species

NFMA regulations require Forests to select Management Indicator Species (MIS) to estimate the effects of each alternative on fish and wildlife populations (36 CFR 219.19). The regulations further direct that MIS should be chosen that indicate the effects of management activities. Categories from which MIS are selected, where appropriate, can include endangered and threatened species, species with special habitat needs that may be influenced by management, game species, non-game species of special interest, and other species whose population changes are believed to indicate the effects of management on other species of major biological communities (36 CFR 219.19(a)(1)). Planning alternatives must be evaluated in terms of habitat and population trends of MIS (36 CFR 219.19(a)(2)), and MIS are to be monitored during Forest Plan implementation and relationships to changes in habitat determined (36 CFR 219.19(a)(6).

MIS were not identified as a major Need for Change issue. MIS were identified as a minor Need for Change issue because the Forest needs to update the MIS list, but the need to do so is not expected to generate substantial controversy or high public interest. However, strategies to address the Vegetation Management Need for Change issue are expected to affect MIS habitat and populations.

The Forest revised its MIS list for several reasons. Experience has shown that some of the MIS chosen for the 1986 Forest Plan are habitat generalists whose populations cannot easily be related to management-related changes in habitat (e.g., white-tailed deer [*Odocoileus virginianus*]), or are wide-ranging species for which controlled studies are difficult (e.g., black bear [*Ursus americanus*]). Other species have proven difficult to monitor because of low populations, sparse distributions, or cryptic habits (e.g., snowshoe hare [*Lepus americanus*]). Also, experiences of National Forests across the nation have shown that MIS lists need to include as few species as possible to ensure that all of the MIS can be monitored adequately within realistic monitoring budgets. The Forest's 10-species MIS list under the 1986 Forest Plan has challenged our ability to collect meaningful monitoring data.

Other Species of Management Interest

Many species on the Forest are important to the public, regardless of whether they are threatened and endangered species, sensitive species, MIS, or other species with viability concerns. Wildlife habitat was not identified as a major Need for Change issue. However, wildlife habitat is likely to be affected by strategies to address the Vegetation and Remote Backcountry major Need for Change issues. The Forest is home to two high-interest game species that are not included in the other wildlife categories analyzed in this EIS: white-tailed deer and black bear.

The white-tailed deer is the most popular game animal in West Virginia (Evans et al. 1998). However, in addition to its value as a game animal, the white-tailed deer is a voracious browser, and high deer densities can affect the composition and structure of forest communities. At high population densities, deer becomes a keystone species with the capacity to hinder forest regeneration, change the composition and structure of the understory, and affect other wildlife species through direct competition and changes in habitat (Feldhamer 2002). While white-tailed deer does not work well as an MIS, its population changes are nonetheless important for management of the Forest.

The black bear is a popular game animal in the region, and is also popular with wildlife watchers. Compared to most other wildlife, black bears have large home ranges and require habitats with low densities of open roads to serve as refuges from disturbance and hunting mortality (Brody and Pelton 1989). Because of this special requirement for large blocks of relatively remote habitat, the Forest provides much of the prime bear habitat in the region. Due to large home ranges, black bear population changes in relation to management activities are difficult to monitor. Therefore, black bear does not make a good MIS. However, it is an important species to consider during management, and it will therefore be analyzed in this EIS.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect habitat for MIS and other species of management interest.

Background

MIS are used to gauge the effects of National Forest Management on wildlife habitat in general. MIS are expected to reflect the effects of the Forest Plan alternatives on ecological communities of management interest. In revising the MIS list, we have emphasized species that are closely associated with habitats of interest. We have also concentrated on species that can produce meaningful data about the effects of Forest management activities on a few major communities of interest. Additionally, we have minimized the list of MIS so that the required level of monitoring effort is something we can reasonably expect to accomplish. Regarding our ability to monitor the species, the general paradigm used was to select species that can be monitored regularly on a Forest-wide basis, but also can be monitored on a site-specific basis from time to time in conjunction with selected management activities. The following specific criteria were used to screen potential MIS:

- Species occurs in a habitat that we are likely to affect through our management, or in a high-interest habitat that drives our management direction.

- Species is closely associated with the habitat of interest, and population levels respond to changes in that habitat (ecological indicator species).

- Species' basic biology (habitat requirements, demography, threats, etc.) is well-known.

- Species is not so rare or cryptic that its populations cannot be monitored effectively with a reasonable amount of effort.

- Species occurs at a scale that allows us to monitor populations in replicated treatment and control units.

- Species is the subject of currently planned or ongoing monitoring that will provide data sufficient to track Forest-wide distribution and trends.

- Species can be monitored at a smaller scale such that controlled, site-specific or watershed-specific studies can be conducted on selected managed areas.

- Populations respond to management quickly enough to allow before-and-after monitoring within a reasonable time frame.

Table MIS-1 summarizes the revised MIS list.

Table MIS-1. Management Indicator Species for the 2006 Forest Plan

Species	Habitat Represented	Reasons for Selection
Wild (naturally reproducing) brook trout (*Salvelinus fontinalis*)	Coldwater streams	High-interest game fish. Top-level predator, population changes reflect an integration of effects to water quality and stream conditions across aquatic ecosystems influenced by management on National Forest System lands. The Forest is developing an aquatic monitoring strategy that will include brook trout.
Cerulean warbler (*Dendroica cerulea*)	Late successional hardwood forests	High-interest non-game species. Associated with large trees, gaps, and complex canopy layering characteristic of old-growth forests. A forest interior species that is believed to be sensitive to fragmentation. The Forest and WV DNR are cooperating on an ongoing songbird point count monitoring program that is expected to provide Forest-wide data on this species.
Wild turkey (*Meleagris gallopavo*)	Mast-producing oak forests with diverse age class distribution and interspersed maintained openings	High-interest game species. In the Appalachians, strongly associated with oak mast. Requires herbaceous openings for brood range and is expected to reflect the effectiveness of the cooperative Forest-WV DNR wildlife opening management effort. Uses shrub/sapling stands for nest sites. Ongoing harvest data collected by WV DNR provides a Forest-wide population index.
West Virginia northern flying squirrel (*Glaucomys sabrinus fuscus*)	Mature and late successional spruce and northern hardwood/spruce forests	High-interest endangered species. Appears to be associated with certain late successional characteristics (snags, canopy gaps, moist microclimate, co-dominance by spruce). The Forest is developing a long-term, Forest-wide monitoring program in cooperation with WV DNR and USFWS.

Habitat indicators for the terrestrial MIS and other species of management interest are described below; indicators for brook trout are discussed in the *Water, Aquatic, and Riparian Resources* section. A limited habitat-related discussion is included here for West Virginia northern flying squirrel, whereas a more detailed analysis for this species is included in the *Threatened and Endangered Species* section.

Many species on the Forest—other than viability concern species, threatened and endangered species, sensitive species, and MIS—are important to the public. While analyzing every species on the Forest is not practical, a few other high-profile game species warrant consideration. As with any species, Forest management activities have the potential to affect habitat for these species.

Indicators

Effects to the following habitats for MIS and other species of interest are analyzed and compared by alternative:

- **Optimum habitat for cerulean warbler –** area of mid-late and late successional (80+ years old) mixed mesophytic and cove forests.

- **Optimum habitat for wild turkey –** area of oak and pine-oak forest of optimum mast-producing age (50-150 years old), plus openings, within Management Prescriptions 2.0, 3.0, 6.1, and 6.3.

- **Optimum habitat for West Virginia northern flying squirrel** (area of mid-late and late successional spruce forest) and potential active spruce restoration areas (roughly - approximated by area of mid-late and late successional northern hardwoods in MP 4.1, outside of current suitable flying squirrel habitat).

- **Edge habitats providing abundant browse for white-tailed deer –** all early successional forest (0-19 years old) plus openings.

- **Optimum habitat for black bear –** 50 to 150-year-old oak and pine-oak forest in MPs with limited public motorized access (MPs 4.1, 5.0, 5.1, 6.1, 6.2, 6.3, and remote backcountry portions of the NRA).

Scope of Analysis

Habitat indicators are discussed in terms of current conditions and projected conditions through the 100-year planning horizon under each of the alternatives. Analysis of indicators for the entire planning horizon allowed us to evaluate the effects of management through a period when existing forest communities will age substantially relative to current conditions. The entire planning horizon also allowed time for management strategies to make progress toward desired conditions. Limiting the analysis to the early decades of the planning horizon would have ignored important changes in the age structure of forested communities in later decades that will result from the current condition and the effects of management activity in the early decades.

However, projections beyond the first decade or two must be viewed with caution because of the potential for changes in management emphasis, as well as substantial uncertainty over factors beyond the control of the Forest, such as continued acid deposition, global climate change, and human population growth. Unless otherwise stated, it was assumed that species population trends would follow habitat trends.

Habitat indicators were projected for Forest Service land to reflect direct and indirect effects of expected future Forest Service management. To the extent possible, habitat indicators were projected qualitatively for non-Forest Service land within the Forest boundary as a way of analyzing the cumulative effects of Forest Service management when combined with past, present, and reasonably foreseeable actions on private land. However, accurate quantification generally was not possible for private land.

CURRENT CONDITIONS

Optimum Habitat for Cerulean Warbler

Mid-late and late successional mixed mesophytic and cove forest is most likely to contain key structural features that are believed to be important for breeding populations of cerulean warblers. These features include tall, large-diameter trees, a mostly closed canopy but with some canopy gaps and complex vertical structure, and large tracts with forest interior conditions (Hamel 2000 and references therein). Estimates of mixed mesophytic and cove forests from the ecosystem diversity analysis were used to depict current conditions, although the age class breakdown was somewhat different from that presented in the ecosystem diversity analysis. Future conditions under the alternatives were projected using Spectrum modeling outputs for the mixed hardwoods forest type group. This group includes the same forest types used to estimate the current extent of mixed mesophytic and cove forests for the ecosystem diversity analysis.

Currently, mid-late and late successional mixed mesophytic and cove forest covers approximately 200,000 acres on Forest Service land. While cerulean warblers do not necessarily inhabit all of this area, and may inhabit other areas not included in this indicator, this forest area is believed to contain the best potential habitat for this species.

Optimum Habitat for Wild Turkey

Acorns are a preferred food of the wild turkey, and availability of acorns can affect their movements, condition, survival rates, vulnerability to hunting, and reproduction rates (Steffen et al. 2002, Ryan et al. 2004). Hard mast-producing hardwood stands are generally considered to be the cornerstone of wild turkey habitat in the eastern U.S. (Wunz and Pack 1992). However, turkeys also need other habitat types interspersed with mast-producing hardwoods. Numerous authors have noted the need for interspersed herbaceous openings, which turkeys use for brood-rearing habitat (e.g., Wunz and Pack 1992, Everett et al. 1985, Pack et al. 1980). Turkeys also need dense, shrubby cover for nest sites. Although such cover can exist and is used by turkeys in mature forest, often turkeys select shrubby nest cover along the edges of openings and in recent even-aged harvest units (Wunz and Pack 1992, Everett et al. 1985). Therefore, the indicator chosen for optimum turkey habitat is those oak and pine-oak sites of optimum mast-producing age, plus openings, within MPs 2.0, 3.0, and 6.1, excluding areas within West Virginia northern flying squirrel suitable habitat. Because of age class diversity goals, these MPs will provide shrubby regeneration areas that can enhance nesting habitat, whereas other MPs that are largely unmanaged are not likely to provide substantial amounts of young regeneration.

The optimum mast-producing age range for the oak and pine-oak forest type groups was considered to be 50 to 150 years. This is a compromise between the optimum mast-producing age range for the white oak group of approximately 70 to 200 years and the optimum range for the red oak group of approximately 50 to 120 years. These age ranges were inferred from information on mast production and longevity presented in Burns and Honkala 1990, Larson et al. 2003, Guyette et al. 2004, Black 2003, Abrams et al. 1997, and Gribko et al. 2002. White oak and red oak optimum ranges were combined because the forest types in CDS did not allow separation of white oaks from red oaks in the Spectrum model.

Current amounts of optimum turkey habitat were estimated using forest types and stand origin dates in CDS for lands in MPs 2.0, 3.0, 6.1, and 6.3, excluding areas within West Virginia northern flying squirrel suitable habitat. Spectrum model outputs for the oak and pine-oak forest type groups aged 50 to 150 years in MPs 2.0, 3.0, 6.1, and 6.3, excluding areas within West Virginia northern flying squirrel suitable habitat, were used to project optimum mast-producing habitat under the alternatives, and openings were estimated by assuming the desired condition of 5 percent maintained openings will be met in MPs 2.0, 3.0, 6.1, and 6.3.

According to this indicator, Forest Service land currently contains approximately 230,000 acres of optimum turkey habitat. Although turkeys inhabit most areas of the forest, this is believed to represent the best potential habitat.

Optimum Habitat for West Virginia Northern Flying Squirrel and Spruce Restoration Areas

West Virginia northern flying squirrels are closely associated with spruce and mixed hardwood-spruce forests (USFWS 2001, Ford et al. 2004, Menzel 2003). Research conducted on and near the Forest suggests that the probability of occurrence of West Virginia northern flying squirrels increases rapidly as the conifer component passes about 30 percent of the overstory (Ford et al. 2004). Although they have been captured in stands of various ages, northern flying squirrels are believed to prefer mature to old-growth stands that feature widely spaced large trees, a moist microclimate, and abundant snags and fallen logs (USFWS 2001, Wells-Gosling and Heany 1984, Ford et al. 2004).

These habitat features are most closely approximated by mid-late (80-120 years old) and late successional (>120 years old) spruce and spruce-hardwood forests. In this analysis, spruce forests are defined broadly to include those mixed hardwood-spruce forests with at least 30 percent spruce, so the spruce forest type group likely includes most of the best habitat. We estimated current optimum West Virginia northern flying squirrel habitat using forest type and stand origin data in CDS. Forest types selected to represent spruce forest were the same as those used to construct the conifer-spruce forest type group for the Spectrum modeling. We projected future optimum habitat using Spectrum outputs for mid-late and late successional conifer-spruce forests. The conifer-spruce forest type group includes some low-elevation hemlock forests that likely are not suitable for West Virginia northern flying squirrels. However, such stands make up less than 1 percent of the area of the forest type group and are not likely to affect the estimates.

We also tracked potential active spruce restoration areas as a secondary indicator of the likely effects of management on West Virginia northern flying squirrel habitat. Although restoration areas may not develop into optimum habitat within the planning horizon, such restoration is an important component of the Forest's strategy to assist in recovery of the species. Because most current spruce forest is already considered occupied habitat and is protected by Forest-wide direction, most of the differences among alternatives with respect to West Virginia northern flying squirrel habitat will occur in spruce restoration areas. Therefore, as an indicator of potential habitat improvement, we tracked the area of mid-late and late successional northern hardwoods allocated to MP 4.1 that are not already considered to be suitable habitat for the flying squirrel. Other forest type groups in MP 4.1 include stands with spruce in the understory or overstory, and based on Forest Plan direction, these areas will be actively or passively restored to spruce. However, northern hardwoods in MP 4.1 represent the areas where active restoration of spruce is most likely to occur.

Forest Service land currently contains about 23,000 acres of mid-late and late successional spruce forest. MP 4.1 does not exist in the current Forest Plan, so currently there is no northern hardwood forest in MP 4.1. While West Virginia northern flying squirrels certainly occur in many areas other than those covered by these indicators, based on recent research, these indicators are believed to represent the optimum potential habitat.

It should be noted that the habitat indicators used here for optimum West Virginia northern flying squirrel habitat do not correspond to the criteria that are currently used to define suitable habitat for the purpose of ESA consultation at the project level. To capture all habitat that might be occupied, the definition of suitable habitat used for project-level consultation is much broader than the optimum habitat indicators used herein. Use of the optimum habitat indicators in this EIS does not imply a change in the suitable habitat definition for project-level consultation. Suitable habitat currently is estimated at approximately 149,000 acres on Forest Service land.

Edge Habitats Providing Abundant Browse for White-tailed Deer

White-tailed deer are adaptable to a wide variety of habitats. The white-tailed deer is an edge species that does best in a mixture of forests, thickets, and fields (DeNicola et al. 2000). Such mixed habitat provides a combination of abundant browse, mast, and cover. Therefore, the area of early successional forest plus the area of herbaceous openings provides a simple index to the availability of edge habitats and browse. Because a very high percentage of National Forest System (NFS) land will remain forested under any possible management scenario, cover and hard mast are not likely to limit deer populations and are not included in this indicator. Within the range of management activity that is likely to occur under any alternative, an increase in young forest and openings is likely to increase the habitat capability for deer.

For existing conditions, early successional forest (0-19 years) was estimated from stand origin dates in the CDS database, and herbaceous openings were estimated using the "open" forest type in CDS. For each alternative, early successional forest was projected using Spectrum modeling outputs, and herbaceous openings were projected by assuming that the goal of 5 percent maintained openings will be met in MPs 2.0, 3.0, 4.0, 4.1, and 6.1, excluding areas within West Virginia northern flying squirrel suitable habitat. This indicator should not be construed as an estimate of actual white-tailed deer habitat, because deer will make at least some use of just about every habitat on the forest. Rather, the indicator serves merely as an index to the degree of edge interspersion within forested habitats.

While habitat capability is important in determining the theoretical deer density that the land can support, hunting is the primary tool used to manage actual population levels (Evans et al. 1999). Most yearling and adult mortality is caused by legal hunting (Pennsylvania Game Commission 2003). To maintain a stable deer population, does should comprise 40 percent of the deer harvested; assuming a recommended hunting pressure of one hunter per 20 to 50 acres can be achieved. Harvests consisting of more than 40 percent does will tend to reduce the population, while harvests of less than 40 percent does will allow the population to increase toward the carrying capacity of the habitat (Crum undated). Deer harvest data for the Forest from 1999 through 2003 show that does have comprised well below 40 percent of the harvest in all areas of the Forest (Crum undated). Under this type of harvest scenario, deer populations should increase toward the carrying capacity of the habitat, and an increase in the edge habitat indicator should portend an increase in the deer population.

Currently there are approximately 47,000 acres of early successional forest and openings on NFS land. This acreage represents the areas of the forest where, other factors being equal, deer populations are likely to be the highest.

Optimum Habitat for Black Bear

Black bear population densities in the Appalachians are inversely related to road densities (SAMAB 1996). Black bears in the Appalachians also depend heavily on hard mast as a fall food source. Hard mast is the key to successful over-wintering and reproduction (Pelton 1989). Therefore, the rough indicator of optimum bear habitat includes areas with low open road densities that also have high mast production potential. Areas with low open road densities include MPs 4.1, 5.0, 5.1, 6.1, 6.2, 6.3, and remote backcountry portions of the NRA. Optimum mast-producing areas include oak and pine-oak forest types in the optimum oak mast age range of 50 to 150 years. Estimates for current conditions were constructed using existing MP boundaries and forest type/year of origin data in CDS. Future conditions under the alternatives were projected using Spectrum modeling outputs for 50 to 150 year old oak and pine-oak types in the primarily non-motorized MPs.

Currently there are approximately 190,000 acres of 50 to 150-year-old oak and pine-oak forest in the primarily non-motorized MP areas on NFS land. Although black bears use a wide variety of habitats throughout the Forest, this indicator is believed to represent optimum habitats with the potential to produce surplus bears to populate less optimum areas within and nearby the Forest.

ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Laws, Regulations, and Policies

Numerous laws, regulations, and policies govern the management of MIS and other species of interest on NFS land. National laws and regulations have also been interpreted for implementation in the Forest Service Manual and Handbook. Some of the more influential laws, regulations, and policies governing management of MIS and other species of interest are listed in Table MIS-2 below:

Table MIS-2. Major Laws, Policies, and Regulations Influencing Management and Protection of MIS and Other Species of Interest on National Forest System Land

Act/Law/Regulation/Policy	Law/CFR/FSM/FSH Number
Fish and Wildlife Coordination Act	16 U.S.C. 661-667e
Multiple Use-Sustained Yield Act	16 U.S.C. 528-531
Sikes Act	16 U.S.C. 670a-670o
National Forest Management Act	16 U.S.C. 1600-1614
Fish and Wildlife Conservation Act	16 U.S.C. 2901-2911
NFMA implementing regulations regarding wildlife, MIS, and habitat management	36 CFR 219.19; 219.27(a)(6), (b)(6)
Directives for Habitat Planning and Evaluation	FSM 2620
Directives for Fish and Wildlife Habitat Management	FSM 2630

Forest Plan Direction and Implementation

Forest Plan direction for MIS and other species of interest occurs at two levels, Forest-wide and Management Prescription. Forest-wide direction includes general goals to provide habitat diversity to maintain populations of MIS and other species of interest, including those that provide hunting, fishing, trapping, and wildlife-viewing opportunities. Forest-wide goals, objectives, standards, and guidelines encourage creation and maintenance of age class diversity, water sources, and herbaceous openings, which benefit wild turkey and white-tailed deer, among other species. Specific direction for West Virginia northern flying squirrel essentially limits vegetation management in suitable habitat to small-scale research and habitat management that has been shown to benefit the squirrel. The revised Forest-wide direction contains direction aimed at avoiding or mitigating population-level negative impacts on Migratory Birds of Conservation Concern, as well as direction to maintain and restore habitat for these birds. Such direction offers some protection to cerulean warbler. The revised Forest-wide direction also includes a general guideline to manage human-caused disturbances to limit disruption during critical life stages. This guideline offers some protection to turkeys and bears, which are sensitive to disturbance.

The individual MPs contain a number of items to protect and enhance MIS and other species of interest. All MPs in the suitable timber base contain goals, objectives, or other direction to maintain a percentage of the MP in permanent openings, which will benefit turkey, deer, and other species. Except for the revised MP 3.0, all MPs in the suitable timber base also contain direction for retention of culls and snags. Retained culls and snags benefit a wide variety of species, including black bear and West Virginia northern flying squirrel. MPs 4.1 and 6.1 contain direction that limits road density to benefit turkey, bear, and other disturbance-sensitive species.

MP 6.1, which emphasizes mast production, a variety of wildlife habitat, and remote habitat for disturbance-sensitive species, has additional direction that protects or otherwise benefits MIS and other species of interest. Much of this direction deals with limiting disturbance, such as direction to harvest no more than 40 percent of a prescription unit in a 10-year period. Other disturbance-related direction includes limitations on road and trail density, direction to close most roads to public motorized use, limitations on disturbance due to special uses and mineral development, and seasonal limitations on green firewood sales. This disturbance-limiting direction protects turkey, bear, and other disturbance-sensitive species. MP 6.1 direction also emphasizes mast production through direction to favor mast-producing trees, shrubs, and vines during timber stand improvement and site preparation work. The revised version of MP 6.1 also contains direction to maintain and restore oaks on appropriate sites through prescribed fire and mechanical vegetation treatments. Direction emphasizing mast production benefits turkey, deer, bear, and many other species.

Effects Common to All Alternatives

Mineral Exploration, Development, and Leasing

Optimum Habitat for Cerulean Warbler - Mineral exploration, development, and leasing activities that occur in mid-late and late successional mixed mesophytic and cove forest will reduce optimum habitat for cerulean warbler anywhere that activities involve removal of the forest canopy. Natural gas leasing is the most common form of mineral development on the Forest. Effects of gas development on major forested communities usually are minor. Typically the maximum surface disturbance associated with each gas well is about 15.5 acres. This includes about 2 acres for the well site, about 2 acres for access roads, and about 11.5 acres of pipelines. Pipelines are approximately 15 to 40 feet wide, and monitoring on the Forest has shown that the tree canopy usually closes over the pipeline within 3 to 5 years. Thus the long-term effects of each gas well amount to the conversion of about 4 acres of forested habitat to non-forested habitat. The maximum density of gas wells in most areas is about one well per 640 acres. Therefore, the long-term effects to optimum cerulean warbler habitat are estimated to include the conversion of less than 1 percent of the habitat in a given area to non-forested habitat.

Development of other federal minerals currently is rare on the Forest, but such development could occur in the future under any of the Forest Plan alternatives. Effects from development of minerals other than gas are difficult to predict because they vary depending on the mineral being developed, recovery methods (subsurface vs. surface mining), the intensity of surface disturbance, and the effectiveness of reclamation. However, any mineral development activity that occurs in mid-late and late successional mixed mesophytic and cove forest is likely to involve at least some long-term loss of optimum cerulean warbler habitat.

Optimum Habitat for Wild Turkey - Surface activities involved with natural gas exploration and development create small herbaceous openings that contribute to optimum turkey habitat. They also remove hard-mast-producing trees when they occur in mature and old oak and pine-oak forests. Generally the areas involved are small, and the beneficial effect of creating herbaceous openings in an otherwise forest-dominated landscape probably outweighs the removal of a few mast trees. At the watershed and Forest-wide scales, the reduction in acreage of mast-producing forest is likely to be negligible. Because the optimum habitat indicator includes mast-producing forest and openings, the conversion of forest to openings will not change the amount of the indicator.

Effects from development of other federal minerals will vary depending on the degree of surface modification. Small operations that create scattered openings are likely to enhance turkey habitat, whereas large operations that remove mast-producing forest over dozens to hundreds of acres would likely be detrimental to turkey habitat, at least at the local and watershed scales.

Any mineral exploration and development would likely have human disturbance associated with the construction, operation, and maintenance activities. While such disturbance is not reflected in this indicator, it can be an important negative influence on nesting and brooding success. However, most optimum turkey habitat occurs in MP 6.1, which contains a standard allowing for restrictions to limit disturbance associated with these activities. Any such effects due to human disturbance would not be reflected in this indicator.

Optimum Habitat for West Virginia Northern Flying Squirrel and Spruce Restoration Areas - Mineral exploration, development, and leasing activities that occur in mid-late and late successional spruce forest will reduce optimum habitat for West Virginia northern flying squirrel anywhere that activities involve removal of the forest canopy. For natural gas development, the amount of habitat modified is small enough that the effects are likely to be negligible at the watershed and Forest-wide scale. Effects due to other mineral development activities are not likely to be substantial because Forest Plan direction prohibits any habitat modification that would adversely affect the squirrel.

Edge Habitats Providing Abundant Browse for White-tailed Deer - Surface activities involved with natural gas exploration and development create small herbaceous openings that increase the amount of edge habitat. Generally, the amount of surface modification associated with natural gas development is a small part of the overall area developed, so the amount of new edge habitat created is likely to be minor. Effects of other mineral development activities will vary depending on the amount of surface modification. Larger areas of surface modification will create larger amounts of edge habitat. As surface modification approaches dozens to hundreds of acres, the interiors of the openings become less suitable for deer due to lack of cover, which begins to reduce the effect of the increase in edge habitat.

Optimum Habitat for Black Bear - The small amounts of open habitat created by natural gas exploration and development are not likely to have substantial negative impacts on optimum black bear habitat. The reduction in hard-mast-producing habitat generally amounts to less than 1 percent of the area developed, and that small loss may be offset to some degree by increased soft mast production around the edges of the openings. Construction, operation, and maintenance activities have the potential to increase human-caused disturbance, but due to activity restrictions in the remote MPs in which optimum bear habitat occurs, these activities are not likely to cause long-term loss of the remote character of the habitat. Access roads and utility corridors associated with gas development will not be open to public motorized access in these remote MPs. However, they could increase foot travel, potentially facilitating a small increase in hunting-related mortality.

Effects of other mineral development will vary according to the amount of surface modification. However, any effects are not expected to be substantial because surface modification that reaches dozens to hundreds of acres probably would be determined to be incompatible with the management emphases of the remote MPs where optimum bear habitat occurs.

Vegetation/Timber Management – Mechanical Treatments

Optimum Habitat for Cerulean Warbler - Even-aged regeneration harvesting in mid-late and late successional mixed mesophytic and cove forest eliminates optimum cerulean warbler habitat in the regenerated area for approximately 80 years. Once desired conditions are achieved within the MPs that are in the suitable timber base, even-aged regeneration harvesting would limit the mid-late and late successional stages to the desired proportion of the landscape. For mixed mesophytic and cove forest in areas that are not otherwise restricted (e.g., West Virginia northern flying squirrel habitat, Indiana bat primary range, spruce restoration areas), the mid-late and late successional stages would be limited to 29 to 50 percent of the landscape in MP 3.0 and 20 to 35 percent in MPs 6.1 and 4.1.

Uneven-aged harvesting and intermediate treatments, such as thinning and timber stand improvement, do not reset the stand age. Therefore, they do not change the amount of optimum cerulean warbler habitat as measured by this indicator. Uneven-aged harvests and intermediate treatments do change forest structure, so they have the potential to affect the quality of the habitat. Such treatments have the potential to speed up development of large trees, canopy gaps, and complex vertical habitat structure, which are believed to be important components of cerulean warbler habitat (Hamel 2000 and references therein). However, some studies have noted declines in cerulean warbler population density and nesting productivity immediately following natural disturbances that created extensive canopy gaps (Hamel 2000 and references therein, Jones et al. 2001). Therefore, it is possible that intensive intermediate treatments could degrade habitat quality, at least in the short term.

Optimum Habitat for Wild Turkey - Even-aged regeneration harvesting in 50 to 150 year-old oak and pine-oak forest eliminates mast-producing forest in the areas harvested. However, such harvesting creates potential nesting habitat, which is one of the factors that contributes to optimum turkey habitat. Also, such harvesting has the potential to regenerate oaks that otherwise might be replaced by shade-tolerant trees; therefore, it contributes to the long-term maintenance of mast-producing capability. Within the MPs that contribute to this indicator, desired conditions call for no more than 24 percent of the landscape to consist of regenerating forests less than 20 years old. Such levels of early successional forest contribute to nesting habitat availability without a major detrimental effect on the amount of older mast-producing forest. However, the optimum habitat indicator measures such harvests as a slight decline in habitat.

Uneven-aged harvests and intermediate treatments do not reset the stand age, so they do not change the amount of optimum turkey habitat as measured by this indicator. Such treatments have the potential, however, to change habitat quality in ways not measured by the indicator in the short term. Uneven-aged harvests and intermediate treatments, to the extent that they favor mast-producing species, have the potential to increase mast production in the retained trees. These treatments also can contribute to the open stand structure that is preferred by turkeys, as long as the treatments do not open up the canopy enough to stimulate dense shrub and sapling growth. However, if uneven-aged harvesting is continued indefinitely, it can cause oaks to be replaced by shade-tolerant species, thereby reducing mast production over the long term. Such a change should be reflected by a change of forest type, which would be measured by this indicator as a reduction in the amount of optimum turkey habitat.

Optimum Habitat for West Virginia Northern Flying Squirrel and Spruce Restoration Areas - Essentially all mid-late and late successional spruce forest is considered suitable habitat for the West Virginia northern flying squirrel. Forest Plan direction requires that vegetation management in suitable habitat be part of research into the effects of management on squirrel habitat, or be part of habitat improvement that has been shown by research to be beneficial to the squirrel. Therefore, any vegetation management that occurs in mid-late and late successional spruce forest is not likely to decrease measurably the amount or quality of this habitat. Any management to improve squirrel habitat is not likely to reset the stand age and, therefore, would not change the amount of this indicator. However, such management may improve the quality of the habitat in ways not measured by this indicator.

Spruce restoration areas that are outside of suitable habitat are not subject to the same restrictions on vegetation management. However, management direction for MP 4.1 emphasizes mainly uneven-aged harvest and intermediate treatments in these areas, which would not reset stand age and, therefore, would not change the amount of the indicator. However, such vegetation treatments could improve habitat quality in ways not measured by the indicator.

Edge Habitats Providing Abundant Browse for White-tailed Deer - Even-aged regeneration harvesting creates edge habitat. Even-aged harvesting will be reflected by an increase in the amount of this indicator. Uneven-aged harvesting and intermediate treatments do not reset the stand age; therefore they do not change the amount of edge habitat as measured by this indicator. Uneven-aged harvesting and intermediate treatments can affect the amount and quality of deer browse if they stimulate understory growth, but such effects would not be captured by this indicator.

Optimum Habitat for Black Bear - Even-aged regeneration harvests in optimum bear habitat eliminate mast-producing forest in the harvested areas, which causes a decline in the amount of this indicator. However, in many areas such harvests may be necessary to maintain oak dominance over the long term, so such harvests can slow or prevent long-term declines in optimum bear habitat. Within MP 6.1, which is the only suitable-base MP with an extensive oak component that contributes to this indicator, desired conditions are designed to maintain the maximum possible amount of the landscape in the optimum mast-producing range. Therefore, over the long term and at the landscape scale, even-aged harvests in these areas are designed to maximize the amount of optimum bear habitat.

Uneven-aged harvesting and intermediate treatments do not reset the stand age; therefore they do not change the amount of optimum bear habitat as measured by this indicator. Such treatments have the potential, however, to change habitat quality in ways not measured by the indicator. Uneven-aged harvests and intermediate treatments, to the extent that they favor mast-producing species, have the potential to increase mast production in the retained trees. However, if uneven-aged harvesting is continued indefinitely, it can cause oaks to be replaced by shade-tolerant species, thereby reducing mast production over the long term. Such a change should be reflected by a change of forest type, which would be measured by this indicator as a reduction in the amount of optimum bear habitat.

Vegetation/Timber Management – Salvage Harvest

Optimum Habitat for Cerulean Warbler - Salvage harvest occurs in stands that have been severely damaged or destroyed by natural disturbances. Salvage harvest is not likely to occur in optimum cerulean warbler habitat, so there is little or no potential for effects on this habitat.

Optimum Habitat for Wild Turkey - Because salvage harvesting removes dead and dying trees in stands that have already been severely damaged or destroyed, it does not appreciably affect optimum mast-producing stands. Therefore, salvage harvesting will have little or no effect on this indicator.

Optimum Habitat for West Virginia Northern Flying Squirrel and Spruce Restoration Areas - Salvage harvesting is not allowed in suitable West Virginia northern flying squirrel habitat, so it is unlikely to occur in mid-late and late successional spruce forest. If an area of mid-late or late successional spruce forest were to be damaged so extensively that it is no longer considered suitable habitat, salvage harvesting could occur. However, the amount of damage necessary to make the area unsuitable for squirrels also would reset the stand age such that it would no longer be considered mid-late or late successional. Therefore, salvage harvest has little or no potential to change the amount of this indicator.

Edge Habitats Providing Abundant Browse for White-tailed Deer - Because salvage harvesting removes dead and dying trees in stands that have already been severely damaged or destroyed, it does not reset stand age and does not produce new edge habitat. Therefore, salvage harvesting will have little or no effect on this indicator.

Optimum Habitat for Black Bear - Because salvage harvesting removes dead and dying trees in stands that have already been severely damaged or destroyed, it does not appreciably affect optimum mast-producing stands. Therefore, salvage harvesting will have little or no effect on this indicator.

Range Management – Livestock Grazing

Optimum Habitat for Cerulean Warbler - Acreage devoted to range allotments has been declining slowly over several decades, and the revised Forest-wide management direction calls for maintenance of existing grazing capacity. Based on current trends and the revised management direction emphasis, new allotments likely will be limited to newly acquired lands that contain pastures. Therefore, range management is not likely to convert any existing mid-late or late successional mixed mesophytic and cove forest to non-forest habitat. If the decline in range acreage continues, some range land would be replaced by forested habitat, but land reforested at the beginning of the planning horizon would not reach the mid-late successional stage until near the end of the planning horizon.

Optimum Habitat for Wild Turkey - Because range acreage is not expected to increase substantially, and any new allotments probably will occur on land that is already open, range management is not expected to appreciably affect optimum turkey habitat. Maintenance of existing allotments would maintain the contribution of these herbaceous openings to beneficial habitat diversity within optimum habitat. Should range acreage continue to decline, the loss of openings would be reflected by this indicator as a slight decline in the amount of optimum turkey habitat. However, desired conditions and goals for maintained openings, if met, would eventually replace any lost openings.

Optimum Habitat for West Virginia Northern Flying Squirrel and Spruce Restoration Areas – Forest Plan direction prohibits new range allotments in West Virginia northern flying squirrel suitable habitat, therefore it is unlikely that any new range allotments would be developed in mid-late or late successional spruce forest. New range allotments in spruce restoration areas are also unlikely due to conflict with the management emphasis in these areas. Should range acreage continue to decline, reversion of allotments in spruce and northern hardwood ecosystems could cause an increase in spruce and northern hardwood forest. Any new spruce and northern hardwood stands that develop due to reversion of range allotments early in the planning horizon would not reach the mid-late successional stage until near the end of the planning horizon.

Edge Habitats Providing Abundant Browse for White-tailed Deer - Because range acreage is not expected to increase substantially, and any new allotments probably will occur on land that is already open, range management is not expected to substantially increase the edge habitats represented by this indicator. Maintenance of existing range allotments maintains the edge habitat that allotments contribute to this indicator. Should range acreage continue to decline, the loss of openings could reduce the amount of this indicator. However, within MPs in the suitable timber base, desired conditions and goals for maintained openings, if met, would replace any openings and associated edge lost through reversion of range allotments.

Optimum Habitat for Black Bear - New range allotments are unlikely to be developed in optimum black bear habitat, so it is unlikely that range management will cause a decrease in this indicator. If range acreage continues to decline, some current range allotments could revert to oak or pine-oak forest. However, any such areas would not reach optimum mast-producing age until at least the middle of the planning horizon. Therefore, range management is not expected to substantially affect optimum black bear habitat.

Fire Management – Fire Suppression

Optimum Habitat for Cerulean Warbler - Fire suppression in mid-late and late successional mixed mesophytic and cove forest protects this fire-sensitive community from destruction by wildfires. Therefore, fire suppression prevents the loss of optimum cerulean warbler habitat. Habitat alterations associated with fire suppression activities (i.e., fire lines) are not expected to be extensive enough to cause a measurable decline in the amount of this indicator.

Optimum Habitat for Wild Turkey - Fire suppression in oak and pine-oak communities prevents operation of the natural fire regime in these fire-adapted communities. In the absence of regeneration cutting and associated site preparation, continued fire suppression over the long term can cause oak seedlings and saplings to be out-competed by fire-sensitive species, leading to a long-term decline in mast production. Such an effect would eventually cause a forest type conversion, which would be reflected in this indicator as a decline in the amount of optimum turkey habitat. However, continued suppression of wildfires in areas that have been subject to long-term suppression can prevent unnaturally intense fires from destroying mast-producing optimum habitat. Habitat alterations associated with fire suppression activities are not expected to be extensive enough to cause a measurable decline in the amount of this indicator.

Optimum Habitat for West Virginia Northern Flying Squirrel and Spruce Restoration Areas - Spruce and northern hardwoods are fire-sensitive communities. Therefore, fire suppression in optimum West Virginia northern flying squirrel habitat and spruce restoration areas prevents wildfires from damaging or destroying these habitats. Habitat alterations associated with fire suppression activities are not expected to be extensive enough to cause a measurable decline in the amount of this indicator.

Edge Habitats Providing Abundant Browse for White-tailed Deer - Fire suppression in edge habitats and early successional regeneration areas allows continued succession of areas that might otherwise be reset to the early successional stage by wildfire. Continued succession reduces quality and quantity of available browse. Eventually, these areas grow out of the early successional stage, resulting in a reduction of the amount of this indicator. Also, by preventing wildfires from killing mature forests, fire suppression prevents the creation of new edge habitats.

Optimum Habitat for Black Bear - Effects of fire suppression on optimum black bear habitat are similar to those described above for optimum wild turkey habitat.

Fire Management – Prescribed Fire Use

Optimum Habitat for Cerulean Warbler - Prescribed fire use in this fire-sensitive community runs the risk of killing the overstory and reducing the amount of optimum cerulean warbler habitat. Low-intensity prescribed fire that does not kill the overstory would eliminate some of the understory and midstory vegetation, thereby reducing the vertical habitat complexity preferred by cerulean warblers. However, such a change in habitat quality would not be detected by this indicator.

Optimum Habitat for Wild Turkey - The oak and pine-oak forests that make up optimum wild turkey habitat typically are fire-adapted. Prescribed burning in these forests can help perpetuate oak reproduction by controlling competition from fire-sensitive vegetation. Therefore, prescribed fire can help prevent loss of optimum turkey habitat that might otherwise occur due to passive conversion to shade-tolerant forest types.

Optimum Habitat for West Virginia Northern Flying Squirrel and Spruce Restoration Areas - Essentially all mid-late and late successional spruce forest is included in West Virginia northern flying squirrel suitable habitat. Any vegetation management that is conducted in suitable habitat, including prescribed burning, must be beneficial for the squirrel. Because the spruce ecosystem is not fire-adapted, it is unlikely that any prescribed burning will be conducted in spruce forest. Therefore, there is little or no potential for prescribed burning to affect mid-late and late-successional spruce forest. Prescribed burning in spruce restoration areas also is unlikely because it is not consistent with the management emphasis of these areas.

Edge Habitats Providing Abundant Browse for White-tailed Deer - Because of the potential for killing desirable regeneration, prescribed burning is not likely to be conducted in early successional regeneration areas after the desired regeneration has become established. However, prescribed fire may be used in combination with shelterwood or two-age prescriptions as a way of enhancing the establishment of desired regeneration. Such prescribed burning will not change the amount of this indicator, but by stimulating succulent new growth, it may improve the quality of browse available in some early successional areas. Prescribed burning may also be used to maintain herbaceous openings, which contribute to this edge habitat indicator. Such burning would contribute to maintaining open and edge habitats that otherwise would revert to forest.

Optimum Habitat for Black Bear - The effects of prescribed fire on optimum black bear habitat are similar to those discussed above for optimum wild turkey habitat.

<u>Roads – Construction, Reconstruction, Maintenance, and Decommissioning</u>

Optimum Habitat for Cerulean Warbler - Road construction and reconstruction converts small amounts of cerulean warbler habitat into non-habitat. Roads usually take up a small proportion of the landscape, so the amount of habitat loss at the watershed and Forest-wide scale is not likely to be substantial. Roads can fragment remaining habitat for this forest-interior species, but it is also possible that narrow roads could mimic the canopy gaps that this species seems to prefer. Such changes in habitat quality would not be reflected in this indicator, which measures only the amount of mid-late and late successional mixed mesophytic and cove forest.

Road maintenance perpetuates the changes caused by road construction. Road decommissioning can reverse the fragmentation effects of road construction, and it assimilates the disturbed areas back into the surrounding forest matrix over time.

Optimum Habitat for Wild Turkey - Road construction and reconstruction eliminates small amounts of mast-producing optimum turkey habitat. Roads usually take up a small proportion of the landscape, so the amount of habitat loss at the watershed and Forest-wide scale is not likely to be substantial. In addition, seldom-used roads can serve as beneficial herbaceous openings that enhance optimum turkey habitat, although such a change in habitat quality will not be reflected in this indicator unless the roads are depicted as openings in the stands database. Road maintenance perpetuates the changes created by road construction, whereas road decommissioning would reverse those changes over time.

Optimum Habitat for West Virginia Northern Flying Squirrel and Spruce Restoration Areas - Due to the restrictions on vegetation management in West Virginia northern flying squirrel suitable habitat, little road construction and reconstruction is likely to occur in mid-late and late successional spruce forest. More road construction is possible in spruce restoration areas. Road construction eliminates small amounts of habitat, but at the watershed and Forest-wide scales, the amount eliminated is not likely to be substantial. Road maintenance perpetuates the changes created by road construction, whereas decommissioning reverses those changes.

Edge Habitats Providing Abundant Browse for White-tailed Deer - Road construction and reconstruction causes a small increase in the openings and associated edge that contributes to this habitat indicator. However, the impact of roads on the amount of this indicator may be too small to measure at the watershed and Forest-wide scales. Road maintenance prevents the loss of edge habitats associated with roads, while road decommissioning removes the edges associated with roads.

Optimum Habitat for Black Bear - Road construction and reconstruction eliminates small amounts of mast-producing optimum black bear habitat. Roads usually take up a small proportion of the landscape, so the amount of habitat loss at the watershed and Forest-wide scale is not likely to be substantial. New roads that are closed to public motorized access generally do not detract from the remote character of optimum black bear habitat, and may actually be beneficial to bears by providing travel ways and soft mast along the edges. New roads that are open to public motorized use reduce optimum bear habitat by the amount of habitat that is made easily accessible by the roads. Road maintenance perpetuates the changes created by road construction, whereas road decommissioning reverses those changes.

Recreation – Developed Recreation

Optimum Habitat for Cerulean Warbler - Developed recreation facilities in mid-late and late successional mixed mesophytic and cove forest reduce optimum cerulean warbler habitat by the amount of land where the forest canopy is removed. Developed recreation sites that do not remove the forest canopy, but reduce vertical habitat complexity by removing understory and midstory vegetation, would have detrimental effects on the quality of cerulean warbler habitat. However, changes in quality will not be reflected in this indicator. At the Forest-wide scale, developed recreation sites are not likely to cover more than a small fraction of the landscape, so substantial effects at the Forest-wide scale are not likely.

Optimum Habitat for Wild Turkey - Developed recreation sites in oak and pine-oak forests of optimum mast-producing age will reduce optimum turkey habitat by the amount of land where the forest canopy is removed. Developed recreation sites that do not remove the forest canopy will likely create human disturbances that are incompatible with turkeys, but such habitat quality effects will not be reflected in this indicator. At the Forest-wide scale, developed recreation sites are not likely to cover more than a small fraction of the landscape, so substantial effects at the Forest-wide scale are not likely.

Optimum Habitat for West Virginia Northern Flying Squirrel and Spruce Restoration Areas - Developed recreation facilities are prohibited in West Virginia northern flying squirrel suitable habitat, therefore developed recreation will not affect mid-late and late successional spruce forest. Developed recreation sites can occur in spruce restoration areas that are not suitable habitat. Any new recreation sites in spruce restoration areas would cause localized reductions in habitat. However, developed recreation sites are not likely to cover large areas of the landscape, so substantial Forest-wide effects are not anticipated.

Edge Habitats Providing Abundant Browse for White-tailed Deer - New developed recreation facilities that supplant openings or early successional regeneration would reduce the amount of edge habitat providing abundant browse for deer. However, new developed recreation sites may create new edge habitats if they are constructed in forested areas. Because developed recreation sites are not likely to cover large areas of the Forest, substantial Forest-wide effects are unlikely.

Optimum Habitat for Black Bear - New developed recreation facilities are inconsistent with the management emphasis of the remote MPs that make up optimum black bear habitat. Therefore, new developed recreation facilities are not expected to affect optimum black bear habitat.

<u>Recreation – Dispersed Recreation</u>

Dispersed recreation can occur in any of the habitats represented by the habitat indicators for MIS and other species of interest. Dispersed recreation typically does not involve removal of the forest canopy or substantial alteration of habitat structure. Therefore, effects of dispersed recreation on all of the habitat indicators for MIS and other species of interest are expected to be negligible. However, dispersed recreation use can cause human disturbance that is detrimental to turkeys and bears. Such non-habitat related effects will not be reflected in the habitat indicators.

<u>Recreation – Motorized Recreation Use</u>

Habitat-related effects of motorized recreation are covered above under the roads subsection. In addition to habitat effects associated with road construction/reconstruction, maintenance, and decommissioning, motorized recreational use in optimum turkey habitat has the potential to disturb turkeys that attempt to use the roads as brooding habitat. Such disturbance is not reflected in the optimum turkey habitat indicator. Disturbance by motorized use in optimum black bear habitat is not likely to be widespread because motorized use is inconsistent with the management emphasis of the remote MPs that are included in the optimum bear habitat indicator.

Soil, Water, Riparian, Aquatic – Active Restoration

Active soil, water, riparian, and aquatic restoration tends to focus on localized areas. Such localized activity has little or no potential for appreciable effects on the amount of any of the habitat indicators for MIS and other species of interest. However, revegetation for sediment and erosion control could eventually lead to reforestation of herbaceous openings. Revegetation of these openings would cause minor decreases in the amount of optimum edge habitat for deer browse and herbaceous openings within optimum turkey habitat.

Soil, Water, Riparian, Aquatic – Passive Restoration

The effects of passive soil, water, riparian, and aquatic restoration on habitat indicators for MIS and other species of interest will be similar to the effects discussed above for active restoration.

Wildlife/Fish Habitat Restoration

Optimum Habitat for Cerulean Warbler - Construction of new wildlife openings in mid-late and late successional mixed mesophytic/cove forest would remove small areas of optimum cerulean warbler habitat. However, all MPs that include a desired condition for wildlife openings call for 8 percent or less of the landscape in maintained openings. Thus the effect of new openings on the amount of optimum cerulean warbler habitat is likely to be minor.

Restoration of forested habitat would have little effect on the amount of optimum cerulean warbler habitat. Any open areas that are reforested early in the planning horizon would not reach the mid-late successional stage until near the end of the planning horizon. Restoration that enhances habitat structure in forested areas could improve the quality of cerulean warbler habitat, but such improvement would not be reflected in this indicator.

Optimum Habitat for Wild Turkey - Construction of new wildlife openings would increase the amount of optimum turkey habitat if their construction does not involve removal of optimum mast-producing oak or pine oak stands. The indicator amount would not change if openings are constructed in optimum mast-producing oak or pine-oak stands. Whether or not the indicator measures a change, construction of wildlife openings within the amount specified by the desired conditions in the MPs will improve the quality of turkey habitat. Restoration of forested habitat would cause a decrease in the optimum turkey habitat indicator if it involves reforestation of openings. Any reforested openings dominated by oaks would not reach optimum mast-producing age until at least the middle of the planning horizon.

Restoration or enhancement of habitat structure in forested areas will not change the value of this indicator. Changes associated with such restoration and enhancement could be considered beneficial or detrimental to turkey habitat quality depending on the way they change habitat structure and/or species composition.

Optimum Habitat for West Virginia Northern Flying Squirrel and Spruce Restoration Areas - Construction of new wildlife openings is not likely to occur in mid-late and late successional spruce forests because of the restrictions on vegetation management in West Virginia northern flying squirrel suitable habitat. Therefore, wildlife openings would have little or no effect on optimum habitat as measured by this indicator. New wildlife openings can be constructed in spruce restoration areas that are not suitable habitat; new openings would be measured as a decrease in the amount of the spruce restoration areas indicator. Because desired conditions call for 3 to 8 percent of the MP area in maintained openings, the effects of new openings on spruce restoration areas would be minor.

Restoration of openings to forested areas would have little effect on the optimum habitat or spruce restoration areas indicators. Any openings restored early in the planning horizon would not reach the mid-late successional stage until near the end of the planning horizon. Restoration and enhancement of habitat structure within forested areas could improve habitat quality for West Virginia northern flying squirrel, but such improvement would not be measured by these indicators.

Edge Habitats Providing Abundant Browse for White-tailed Deer - New wildlife openings, if constructed in forests older than 19 years, will increase the amount of edge habitats as measured by this indicator. Restoration of openings to forested habitat would cause no change in edge habitat measured by this indicator for the first 19 years, but in year 20 would be reflected as a reduction in the amount of this indicator. The effects of restoration and enhancement of habitat structure in forests on deer browse would vary depending on the type and degree of alterations, but any such changes will not be measured by this indicator.

Optimum Habitat for Black Bear - New wildlife openings, if constructed in 50 to 150 year-old oak or pine-oak forests in remote MPs, would cause a decline in the optimum bear habitat indicator. The decline is not expected to be substantial because desired conditions call for only 3 to 8 percent openings in MPs 6.1 and 4.1, and no additional openings in the other remote MPs. In addition, such openings could have the beneficial effect of increasing soft mast production, which would not be measured by this indicator.

Restoration of openings to forested habitats would have little effect on this indicator. Any reforested areas would not reach optimum mast-producing age until at least the middle of the planning horizon. Any soft mast associated with the openings probably would be lost or greatly reduced, but this subtle change in habitat quality would not be reflected in the indicator. Effects of habitat structure restoration within forested areas will vary depending on the type and degree of changes to habitat structure, but because any such changes will not change the amount of optimum mast-producing forest, the changes will not be measured by this indicator.

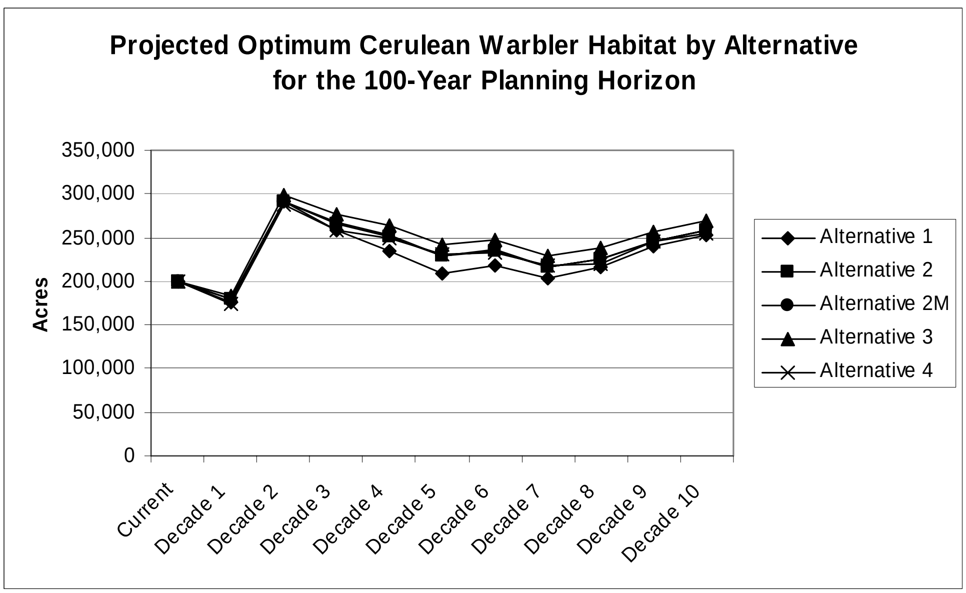
Direct and Indirect Effects by Alternative

Optimum Habitat for Cerulean Warbler

Projected optimum habitat for cerulean warbler during the 100-year planning horizon follows a similar pattern under all alternatives, with minor differences in the amount in certain decades

(Figure MIS-1). In the first decade, optimum cerulean warbler habitat is projected to drop from the current approximately 200,000 acres to around 175,000 to 180,000 acres under all alternatives. This small decline is due to projected timber harvesting in 80+ year-old mixed mesophytic stands. The decline is projected to be short-lived, however, followed by a large increase to about 290,000 to 300,000 acres in the second decade under all alternatives. This increase is due to the large acreage of current mid-successional mixed mesophytic stands reaching 80+ years old in the second decade. Following this increase, a gradual decline is projected through the seventh decade for all alternatives as harvesting to achieve age class diversity removes some mid-late and late successional stands. During this time small differences among alternatives are apparent. The amount is projected to decline the most under Alternative 1 and the least under Alternative 3. The difference among alternatives is projected to be greatest in the fifth decade, when Alternative 1 will provide a little less than 210,000 acres and Alternative 3 will provide a little over 240,000 acres. Alternatives 2, 2M, and 4 are each projected to provide around 230,000 acres in the fifth decade. After the fifth decade, optimum cerulean warbler habitat is projected to decline a little more through the seventh decade, reaching a little over 200,000 acres under Alternative 1, about 230,000 acres under Alternative 3, and 215,000 to 220,000 acres under Alternatives 2, 2M, and 4. The amount is projected to rise gradually under all alternatives in the eighth through tenth decades, with the differences among alternatives becoming smaller and all alternatives finishing between 250,000 and 270,000 acres.

Figure MIS-1.

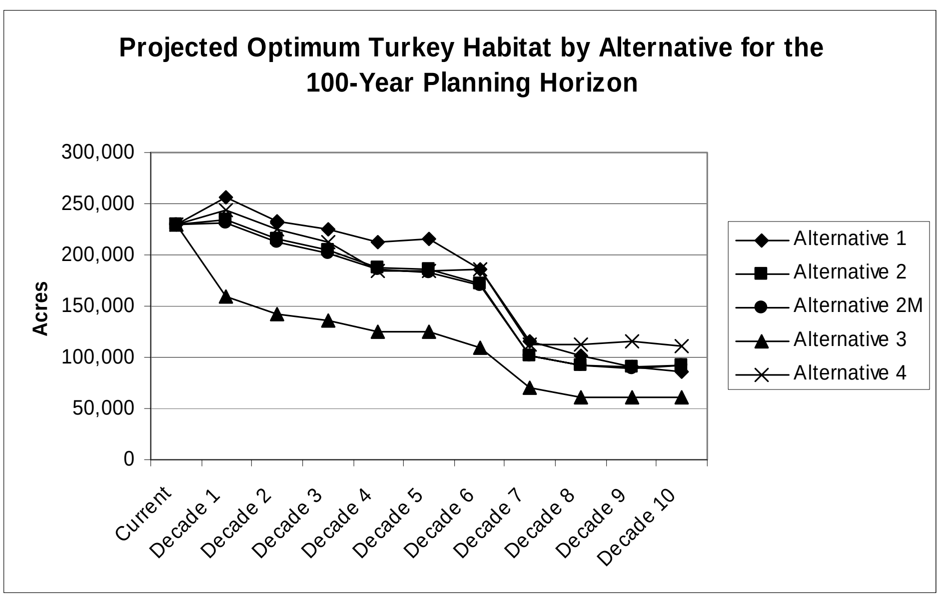


In every decade of the planning horizon, the amount of optimum habitat produced by each alternative exceeds at least 3.5 times the 50,000-acre cerulean warbler habitat objective set by Partners in Flight for the entire mid-Atlantic Ridge and Valley physiographic area (Partners in Flight 2003). This physiographic area covers over 12,000,000 acres in eastern West Virginia, western Virginia, and western Maryland, and the habitat definition used by Partners in Flight was broader than the habitat definition used in this EIS. Therefore, all alternatives should provide ample habitat for cerulean warblers. However, this may not necessarily translate to an increasing or stable population due to habitat destruction on this species' tropical wintering grounds. (Hamel 2000).

Optimum Habitat for Wild Turkey

Due to aging and harvesting of oak and pine-oak stands that currently are in the optimum mast-producing range, optimum turkey habitat will decline throughout the planning horizon under all alternatives (Figure MIS-2). Because this indicator considers only those optimum mast-producing stands and openings that are in MPs 2.0, 3.0, and 6.1, the decline will be most pronounced under Alternative 3, which allocates large areas to MPs 5.1 and 6.2 that currently are MP 6.1. Through the fifth decade of the planning horizon, the decline would be gradual, as timber harvesting to achieve age class diversity removes some 50- to 150-year-old oak and pine-oak stands. In the fifth decade, Alternative 1 would provide the most optimum turkey habitat, at about 215,000 acres, while Alternative 3 would provide the least, 125,000 acres. Alternatives 2, 2M, and 4 would each produce about 185,000 acres. The projected decline becomes much steeper in the sixth and seventh decades as many stands that are currently in the optimum mast-producing range age beyond 150 years. The projected decline levels off in the eighth through tenth decades as stands harvested in the early decades reach the optimum mast-producing range. Because Alternative 4 has the highest harvest levels in the early decades, it has the highest amount of projected optimum turkey habitat in the eighth through tenth decades. In the tenth decade, Alternative 4 would provide just more than 110,000 acres. Alternative 3 still is projected to have the lowest amount of optimum turkey habitat; it would provide a little over 60,000 acres in the tenth decade. Alternatives 1, 2, and 2M would provide between 85,000 to 90,000 acres.

Figure MIS-2.

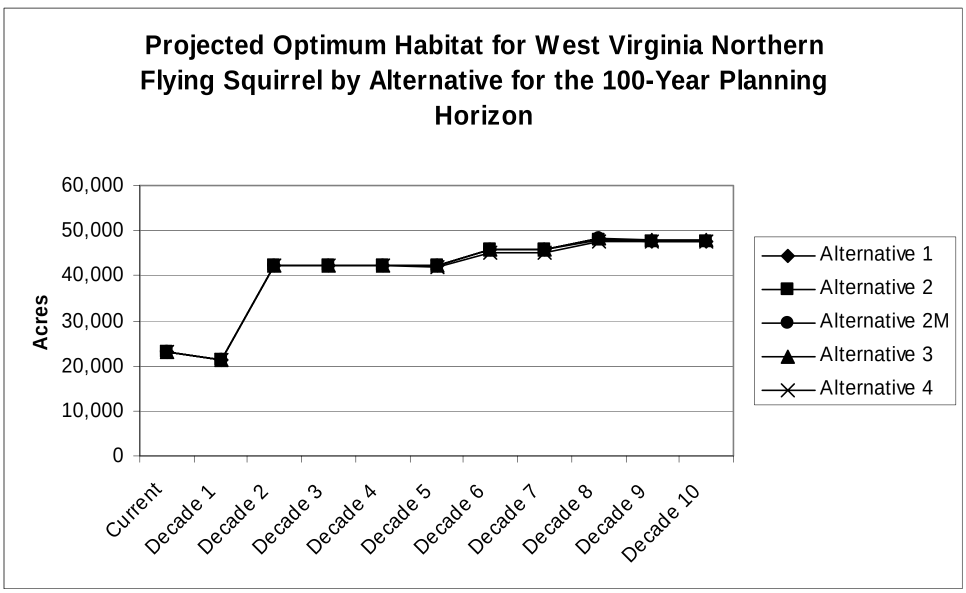


Most of the future decline in optimum turkey habitat is due to the current concentrated age class distribution of the Forest. The current concentration of nearly all oak and pine-oak stands in the optimum mast-producing age range is not sustainable over the long term under any possible management scenario. Because of the inevitable decline in optimum habitat, the Forest's carrying capacity for turkeys is expected to decline under all alternatives, particularly in the later decades of the planning horizon. The decline would be more pronounced under Alternative 3 than the other alternatives, especially during the first half of the planning horizon.

Optimum Habitat for West Virginia Northern Flying Squirrel and Spruce Restoration Areas

Optimum habitat for West Virginia northern flying squirrel is projected to increase substantially under all alternatives. By the second decade of the planning horizon, optimum habitat would increase from the current 23,000 acres to about 42,000 acres, regardless of alternative (Figure MIS-3). Optimum habitat amounts would show the same increase across alternatives because essentially all spruce forest is considered suitable habitat for the West Virginia northern flying squirrel, and most kinds of vegetation management are restricted in suitable habitat. Therefore, spruce forest will continue to age under all alternatives, and after 20 years the great majority of it will have reached the optimum mid-late and late successional stages. After the first two decades, a continued gradual increase is projected, with the amount reaching about 48,000 acres under all alternatives in the eighth through tenth decades.

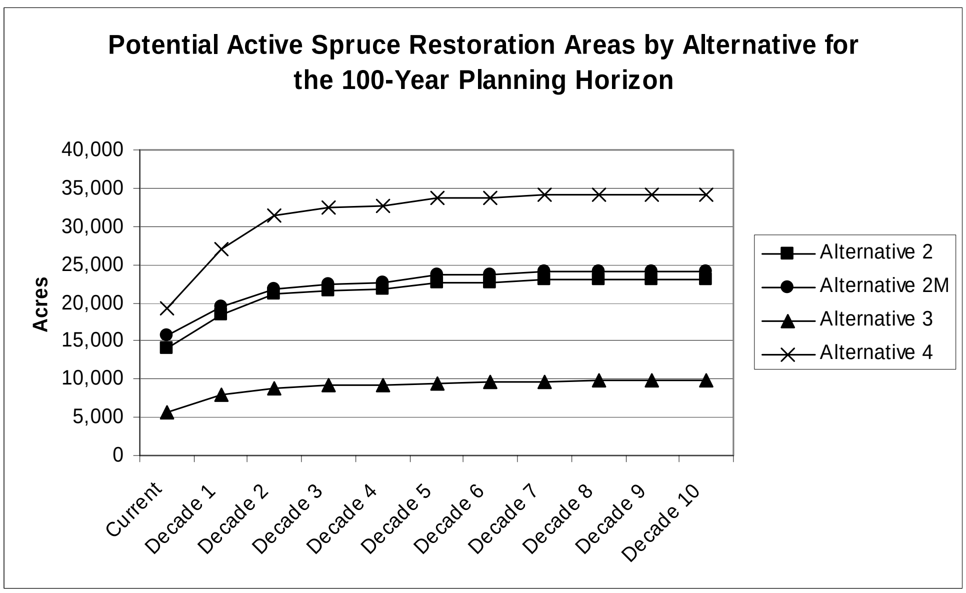
Figure MIS-3.



Potential active spruce restoration areas, which are roughly approximated by ≥ 80-year-old northern hardwoods within MP 4.1 that are not currently considered suitable habitat, are projected to increase gradually under the action alternatives in the early decades of the planning horizon (Figure MIS-4). Alternative 1, which does not include MP 4.1, does not provide any potential active spruce restoration areas as measured by this indicator, though it is possible that the Forest could decide on a project-by-project basis to restore spruce in other MPs. Under the action alternatives, the gradual increase would level off around the fifth decade and the amount would remain stable through the remainder of the planning horizon. Although the pattern is the same, the amounts differ among the action alternatives. Alternative 4 would provide the most potential active spruce restoration area, with the amount leveling off at about 34,000 acres in the fifth through tenth decades. Alternative 3 would provide the least, with a little less than 10,000 acres in the fifth through tenth decades. Alternatives 2 and 2M would be intermediate, with about 23,000 to 24,000 acres in the fifth through tenth decades. Under all action alternatives, the gradual increase in amount in the early decades of the planning horizon is due to aging of northern hardwood stands in the absence of even-aged regeneration harvesting. The differences in amount among alternatives are entirely due to differences in land allocation to MP 4.1.

Other factors being equal, the increase in the amount of optimum habitat under all alternatives should increase the Forest's carrying capacity for West Virginia northern flying squirrel. Under the action alternatives, spruce restoration should increase the carrying capacity further, with the greatest total increase in carrying capacity occurring under Alternative 4 and the smallest total increase occurring under Alternative 3.

Figure MIS-4.

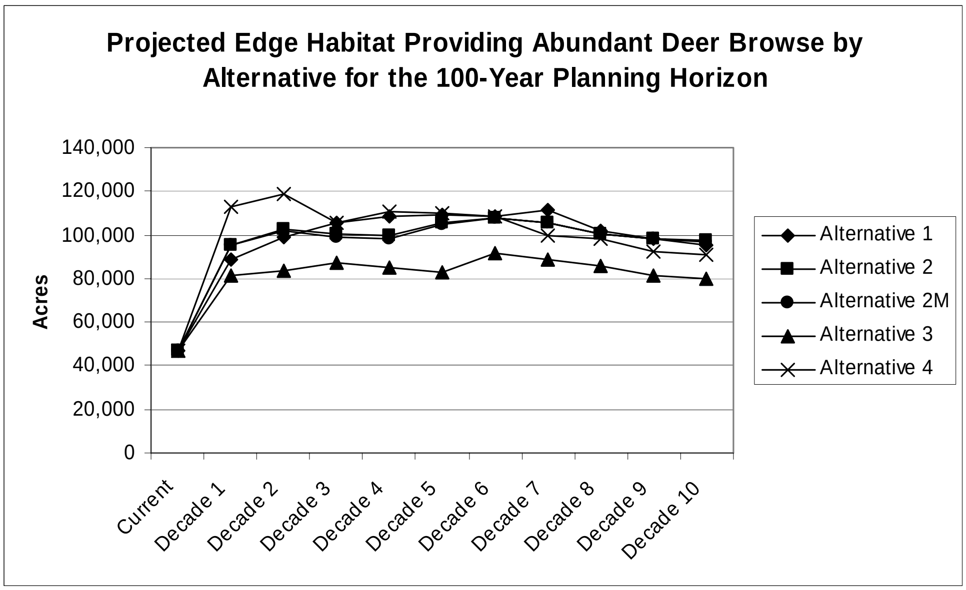


<u>Edge Habitats Providing Abundant Browse for White-tailed Deer</u>

Edge habitats providing abundant browse for white-tailed deer are projected to increase sharply in the first and second decades of the planning horizon as harvesting to achieve age class diversity begins (Figure MIS-5). The increase would be greatest under Alternative 4, with the amount reaching nearly 120,000 acres by the second decade. The increase would be smallest under Alternative 3, with the second-decade amount reaching about 83,000 acres. Amounts under Alternatives 1, 2, and 2M would reach around 100,000 acres in the second decade. In the third decade, the amount under Alternative 4 would decline somewhat such that the amounts under Alternatives 1, 2, 2M, and 4 would be similar. For the third through seventh decades, the amount under these three alternatives would fluctuate between 100,000 and 110,000 acres. Under Alternative 3, this indicator would fluctuate between about 80,000 and 90,000 acres during the entire planning horizon.

These increases in edge habitat should allow corresponding increases in the Forest's carrying capacity for deer. The increase in carrying capacity would be somewhat smaller under Alternative 3 than under the other alternatives. Hunting regulations and hunting pressure, however, determine the doe harvest, which will determine whether the deer population actually reaches the increased carrying capacity.

Figure MIS-5.



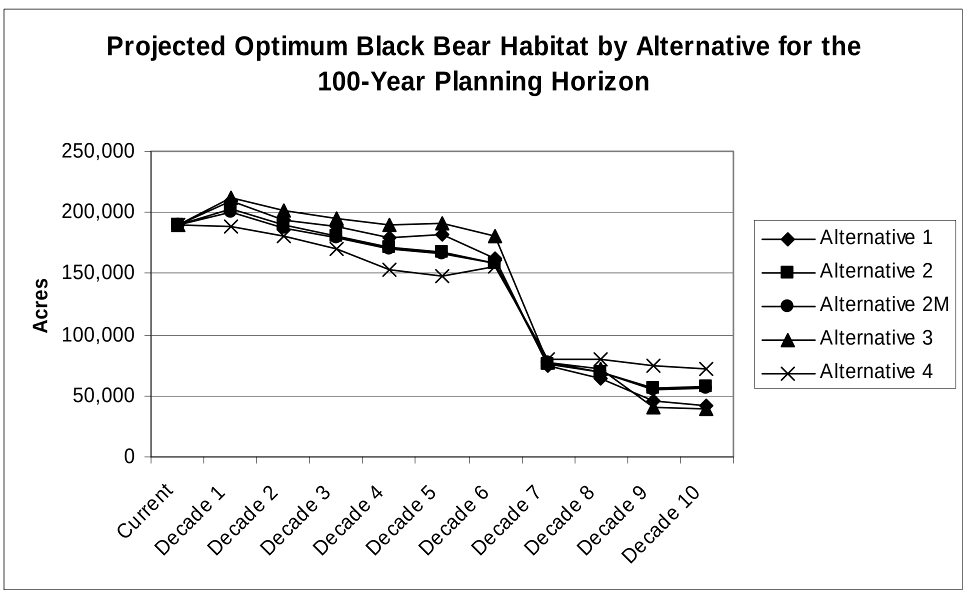
Optimum Habitat for Black Bear

Due to aging and harvesting of oak and pine-oak stands that currently are in the optimum mast-producing age range, optimum habitat for black bear would decline throughout the planning horizon under all alternatives (Figure MIS-6). For the first six decades, the decline would be gradual and would be due primarily to harvesting of stands that are in the optimum mast-producing age range. During this time, Alternative 4 would produce the least optimum bear habitat, primarily because of lower land allocations to remote MPs, but also because of higher harvesting levels. The differences among alternatives would be greatest in the fifth decade, when Alternative 4 would provide just over 140,000 acres of optimum bear habitat, while Alternatives 1 and 3 would provide over 180,000 acres. In the seventh decade, optimum bear habitat would decrease substantially regardless of alternative, with all alternatives producing 70,000 to 75,000 acres. This large decrease is due to aging of oak and pine-oak forest beyond the optimum mast-producing age range. In the remaining decades of the planning horizon, Alternative 4 would provide somewhat more optimum bear habitat than the other alternatives.

This is because the higher level of harvesting early in the planning horizon under Alternative 4 would produce more acreage to mature into the optimum mast-producing age range during the later decades of the planning horizon. Under Alternative 4, optimum bear habitat would level off at 70,000 to 75,000 acres during the eighth through tenth decades. Under Alternatives 1 and 3, optimum bear habitat would decline gradually for the remainder of the planning horizon, reaching about 40,000 acres by the tenth decade. Alternatives 2 and 2M would also produce a gradual decline during these decades, but would not decline as much, producing about 55,000 acres in the tenth decade.

As with optimum turkey habitat, a large decline in optimum bear habitat over the planning horizon is unavoidable because of the current concentrated age class distribution of the Forest. The current high levels of optimum bear habitat are not sustainable under any possible management scenario. The projected declines in optimum bear habitat are expected to cause a decline in the Forest's carrying capacity for bears. Through the first five decades of the planning horizon, the decline would be greatest under Alternative 4, but optimum habitat and presumably carrying capacity would remain fairly high under all alternatives. After the habitat crash in the seventh decade, optimum habitat and presumably carrying capacity would be low under all alternatives, but would remain somewhat higher under Alternative 4 than under the other alternatives.

Figure MIS-6.



Cumulative Effects

The analysis of cumulative effects on habitat for MIS and other species of interest considers the potential effects of activities on all land within the Forest boundary, regardless of ownership. Because almost half of the land within the Forest boundary is not Forest Service land, private activities will account for a large share of the cumulative impacts of all activities. A variety of private activities have the potential to affect habitat, including timber harvest, oil and gas development, agriculture, mining, residential and commercial development, and passive management that allows stands to grow older.

Timber harvest and passive management have the greatest potential to affect habitat over large areas. The other activities are likely to result in localized temporary or permanent losses or changes to habitat. Based on FIA data, the current trend on private land is toward a slow increase in mature and late successional forested habitat, and a slow decrease in early successional forested habitat. If this trend continues, private lands are likely to make a larger contribution to the total amount of mature and late successional forest communities within the Forest boundary (see Cumulative Effects of the *Ecosystem Diversity* section for further discussion).

Optimum Habitat for Cerulean Warbler

If the trend toward aging forests on private land within the Forest boundary continues, it would add to the projected increase in cerulean warbler habitat on NFS land in the second decade of the planning horizon, and would tend to offset the gradual decline on NFS land during the third through seventh decades. The precise amount of habitat on non-NFS land cannot be predicted, so it is not possible to say with any certainty whether the net cumulative amount of habitat within the Forest boundary would increase or decrease during middle and later decades of the planning horizon. However, under any of the action alternatives, the cumulative amount of optimum cerulean warbler habitat would be somewhat higher than under Alternative 1 because Alternative 1 produces the smallest amount on NFS land. Regardless of the effects of activities on private land, all alternatives will produce large cumulative amounts of cerulean warbler habitat within the Forest boundary because all alternatives will produce in excess of 200,000 acres on NFS land in most decades of the planning horizon.

Optimum Habitat for Wild Turkey

On private land within the Forest boundary, optimum wild turkey habitat could increase during the early decades of the planning horizon as forests continue to grow out of the seedling/sapling and poletimber stages into the sawtimber stage, which roughly corresponds to the optimum mast-producing age range for most oaks. Equating this aging with an increase in optimum turkey habitat assumes that herbaceous openings would be available. In many areas of private land, openings generally are provided by pastures, hay land, gas well sites, and unimproved roads. An increase in optimum turkey habitat on private land would at least partly offset declines in optimum turkey habitat on Forest Service land during the early and middle decades of the planning horizon. However, the potential increase on private land cannot be predicted accurately enough to determine whether the cumulative amount within the Forest boundary will increase or decrease. Alternative 4 provides the greatest chance for a cumulative increase because it is projected to cause the smallest decrease on Forest Service land. Alternative 3, which causes the largest decrease on Forest Service land, provides the smallest chance for a cumulative increase on all lands within the Forest boundary.

Without substantial increases in timber harvesting in the early decades of the planning horizon, private lands are likely to be subject to the same steep decline in optimum mast-producing stands that NFS land are projected to experience in the later decades of the planning horizon. Thus, the cumulative long-term trend within the Forest boundary under all alternatives is likely to be a large decline in optimum turkey habitat, with NFS and private lands contributing measurably to this trend. Although this large decline would occur under all alternatives, Alternative 3 would produce the smallest cumulative amount of optimum turkey habitat in the later decades of the planning horizon, whereas Alternative 4 would produce the most.

Optimum Habitat for West Virginia Northern Flying Squirrel and Spruce Restoration Areas

Because almost all current spruce forest within the Forest boundary is on NFS land, cumulative changes to optimum West Virginia northern flying squirrel habitat will be due almost entirely to those found in the Direct and Indirect Effects section above. Active spruce restoration also is expected to be limited almost entirely to NFS land, so cumulative changes in active spruce restoration areas also will be essentially equivalent to the direct and indirect effects discussed above.

Edge Habitats Providing Abundant Browse for White-tailed Deer

On private land, the trend toward aging of forests, if it continues, would cause a decline in edge habitats. This declining trend will tend to offset the increases that are projected to occur early in the planning horizon on NFS land, but the potential changes on non-NFS land cannot be estimated accurately enough to determine whether the cumulative effect on all land in the Forest boundary will be an increase or a decrease in the amount of edge habitat. Alternative 4, which has the largest increase on Forest Service land early in the planning horizon, would be most likely to show a cumulative increase, whereas Alternative 3, which has the smallest increase on Forest Service land, would be least likely to show a cumulative increase.

Optimum Habitat for Black Bear

On private land, a continuation of the current trend toward increases in sawtimber stands could cause an increase in optimum black bear habitat, assuming the sawtimber size class roughly equates to oaks in the optimum mast-producing age range. However, continuing residential and mineral development could increase motorized access, which might offset habitat gains due to increases in the amount of mast-producing forest. The extent to which these two effects would offset each other is not predictable. Therefore, when combining these effects with the projected gradual decline on Forest Service land in the first six decades of the planning horizon, it is not possible to predict whether the cumulative effect will be an increase or decrease in optimum black bear habitat. However, because Alternatives 1 and 3 are projected to produce the largest amount of optimum black bear habitat on Forest Service land during the first six decades, they are the most likely alternatives to show a cumulative increase, whereas Alternative 4 is the least likely alternative to show a cumulative increase.

During the seventh through tenth decades, private lands are likely to experience the same steep decline in optimum mast-producing stands that is forecast for NFS land, unless a substantial increase in even-aged timber harvesting occurs very early in the planning horizon. Therefore, the cumulative long-term trend within the Forest boundary under all alternatives is likely to be a large decline in optimum bear habitat, with NFS land and private land contributing measurably to this trend. Although this large cumulative decline would occur under all alternatives, Alternative 4 would produce somewhat more bear habitat in the later decades than the other Alternatives.

Threatened and Endangered Species

INTRODUCTION

The Monongahela National Forest (MNF) is known for its diversity, for which there are many reasons. The Forest is situated geographically so that it is at the southern reaches of some species, and the northern extent of others. Elevations vary by 4,000 feet, and precipitation ranges from 30 to 60 inches a year, depending on locale. There are also a large variety of land, soil, and forest types on the MNF. Contributing to this diversity are many rare species and communities. Some of these plants are rare or imperiled enough that they have been federally listed under the Endangered Species Act (ESA) for protection. There are currently four listed plant species and five listed animal species on the MNF. This analysis looks at how proposed management alternatives and direction in plan revision may affect these listed species or their habitats.

Need For Change

During the Analysis of the Management Situation, no specific need for change was identified for the way the 1986 Forest Plan (as amended) addresses threatened and endangered (T&E) species and their habitats. However, in drafting the 2006 Forest Plan, greater emphasis was placed on threatened, endangered, and rare plant communities by describing desired future conditions, incorporating key elements of the 2004 T&E Species Amendment, and expanding the overall management direction related to rare plants and communities.

The Forest Service Manual directs that the Forest will:

- Manage habitats and activities to achieve recovery objectives for T&E species.
- Emphasize conservation and recovery of T&E and proposed species and their habitats.
- Prescribe measures to prevent adverse modification of essential habitats.
- Protect individuals from harm.

The 1986 MNF Forest Plan was developed to maintain or enhance species composition, structure and function of central Appalachian ecosystems while providing various goods and services to the American people. Since 1986, the Plan has been amended based upon various changed conditions, including changes to listed species and new information on T&E species habitats.

<u>Threatened and Endangered Species Amendment to the 1986 Plan</u>

The MNF completed a T&E Species Amendment to the 1986 Plan in March, 2004. As part of the amendment process, a biological assessment (BA) pertaining to the nine federally listed species occurring on the MNF was completed. During the assessment, the USFWS recommended the development of new habitat identification and management guidelines for the West Virginia northern flying squirrel. The USFWS amended the Appalachian Northern Flying Squirrel's Recovery Plan (USFWS 1990) in September, 2001 (USFWS 2001).

The BA concluded that for all T&E species found on the MNF, with the exception of the Indiana bat, continued implementation of the 1986 Forest Plan would result in a no effect or may affect, not likely to adversely affect determination. The BA also concluded that continued implementation of the 1986 plan would result in a may affect, likely to adversely affect determination for the Indiana bat for timber harvest, road construction/reconstruction, mineral development, and prescribed fire.

The Forest Service and USFWS entered into formal consultation for the Indiana bat on November 9, 2001 and the Service issued their final programmatic Biological Opinion and Incidental Take Statement in March 2002. Specifically, the Incidental Take Statement anticipates the taking of an unquantifiable number of Indiana bats from tree removal activities and prescribed burning occurring outside of the hibernation period (April 1 – November 14) annually on the MNF. Activities limited annually by the Incidental Take Permit include:

- Timber harvest on up to 6,000 acres,
- Road construction/reconstruction on up to 47 acres,
- Mineral development on up to 78 acres, and
- Prescribed burning on up to 300 acres.

The T&E Species Amendment incorporated reasonable and prudent measures and terms and conditions identified in the Biological Opinion and was approved in March 2004.

Issues and Indicators

Issue Statement

Forest plan management strategies may affect federally listed species and their habitats.

Background

Federal agencies must comply with the ESA of 1973 as amended, which includes a requirement to consult with the U.S. Department of Interior, Fish and Wildlife Service (USFWS) on projects that may affect federally listed threatened, endangered or proposed species. Currently there are 9 federally listed species known to occur on the MNF, but no species that are proposed for listing.

Although Forest Plan revision would have no direct effects on T&E species, Plan revision does provide for species protection and habitat restoration through management direction and the allocation of management prescriptions that would limit or prohibit management activities that pose a threat to T&E species or their habitats. Other management prescriptions could allow certain activities that may pose threats. This analysis will look at the relationships between those prescriptions and how management allowed within them may potentially affect listed species and their habitats.

Indicators

For each listed species, effects are assessed by determining whether management direction in place is adequate to protect listed species and their habitats from potential direct, indirect, and cumulative effects of the four management alternatives considered in detail. Potential effects for some species are based on the level and intensity of management activities that could occur under the Management Prescriptions assigned to each alternative. Specifically, the following key habitat components are used to assess effects on these species:

Running buffalo clover:
- Potential effects to young and old successional stages of mixed mesophytic forest by alternative

Shale barren rock cress:
- Potential effects to shale barrens by alternative

Small whorled pogonia:
- Potential effects to old and mature mixed mesophytic forest, old and mature oak forests, and old and mature pine-oak forests by alternative

Virginia spiraea:
- Potential effects to the banks of low-elevation large streams by alternative

Virginia big-eared bat:
- Potential effects to foraging area by alternative
- Potential effects to maternity and hibernacula sites by alternative

Indiana bat:
- Potential effects to maternity site habitat by alternative
- Potential effects to hibernacula by alternative
- Potential effects to key area habitat by alternative
- Potential effects to primary range by alternative

West Virginia northern flying squirrel:
- Potential effects to suitable habitat (high-elevation spruce and spruce-hardwood forests) by alternative

Cheat Mountain salamander:
- Potential effects to Cheat Mountain salamander habitat by alternative

Bald eagle:
- Potential effects to nesting habitat in riparian areas by alternative.

Additionally, species viability outcomes from the Species Viability Evaluation will be used as an indicator of potential cumulative effects on all the species noted above.

Scope of the Analysis

The affected area for direct and indirect effects to threatened and endangered species and their habitats are the lands administered by the MNF in West Virginia. This area represents National Forest System lands where T&E species occur and may occur, and where management activities may affect individuals and populations. For analysis of cumulative effects, both National Forest System lands and lands of other ownership within the proclamation boundary will be considered. Past, present, and reasonably foreseeable actions on all lands are considered.

For direct, indirect, and cumulative effects, the time frame for analysis is the 100-year planning horizon. Analysis over the entire planning horizon allowed us to evaluate the effects of management through a period when existing forest communities will age substantially relative to current conditions. However, projections beyond the first decade or two must be viewed with caution because of the potential for changes in management emphasis, as well as substantial uncertainty over factors beyond the control of the Forest, such as continued acid deposition, global climate change, and human population growth.

CURRENT CONDITIONS

The section includes an overview of the affected environment, and descriptions of species that are currently listed as threatened or endangered under the ESA, with information on their national, regional, and local habitats. There are currently 4 listed plant and 5 listed animal species known for the MNF. There are no species currently proposed for federal listing.

Within the proclamation and purchase unit boundaries of the Forest are approximately 1.7 million acres. Of these, about 919,000 acres are in federal ownership. The MNF is situated at the intersection of the southern reaches of some tree and plant species, and the northern extent of others. The Forest is mountainous, with a range in elevation from about 900 feet to a maximum of 4,863 feet mean sea level, further contributing to the wide diversity in vegetation. The general axis of the Forest is northeast to southwest.

The Forest spans portions of two sub-regional ecologic sections: Section M221A - The Northern Ridge and Valley, and Section M221B - The Allegheny Mountains. The Allegheny range creates a rain shadow effect, with precipitation on the eastern side averaging 30 to 45 inches per year and the western slopes averaging 45 to 60 inches.

The Forest is further divided into subsections, encompassing one subsection within Section M221, Subsection M221Aa - The Ridge and Valley, and four subsections within Section M221B, Subsection M221Ba – Northern High Allegheny Mountains, Subsection M221Bb – Western Allegheny Mountains, Subsection M221Bc – Southern High Allegheny Mountains, and Subsection M221Bd – Eastern Allegheny Mountain and Valley. These are nationally delineated subsections of the ecological units in the United States. Monongahela National Forest personnel classified the Forest by Landtype Associations (LTA) to better describe the local conditions and aid in large-scale planning. LTAs are divisions of the land at a landscape scale and are smaller than subsections but larger than ecological landtypes. There are 26 LTAs on the MNF, representing an integration of climate, geomorphology, and broad assemblages of vegetation. These LTAs contain repeating patterns of soil and vegetation groupings that are further delineated at the ecological landtype scale. The LTAs identified for the MNF can be grouped by five broad vegetation zones: red spruce, mixed mesophytic hardwoods, northern hardwoods, xeric oaks, and alluvial riparian zones of major rivers.

Threatened and Endangered Plant Species

The diverse landscape described above provides habitat for four federally threatened or endangered plant species. These are: running buffalo clover (*Trifolium stoloniferum*), shale barren rock cress (*Arabis serotina*), small whorled pogonia (*Isotria medeoloides*), and Virginia spiraea (*Spiraea virginiana*). Habitats for these plants range from river banks to shale barrens and rich woods, and are described in detail for each species below.

Running Buffalo Clover (*Trifolium stoloniferum*)

Running buffalo clover (RBC) is a federally endangered perennial clover found on rich, fertile, semi-shaded habitats. This plant has been found in open forests, lightly disturbed areas such as old logging roads, and old farmsteads and cemeteries.

For the Species Viability Evaluation conducted for this analysis, young and old successional stages of mixed mesophytic forests, and acres of woodlands/savannahs were used to estimate habitat. These features can only provide a rough approximation of RBC habitat, given the broad scale of the analysis and the limited data available on this species and its suitable habitat. Current estimates of woodland savannah habitat include hay fields and pastures, and constitute the bulk of the acreage. Estimates of habitat affected by the implementation of the Forest Plan do not include the woodland/savannah habitat because this type may not represent suitable habitat for RBC on the Forest. All of the old successional stage is not suitable habitat because not all of it is likely to have a broken canopy or the preferred limestone-derived soils. Likewise, the entire young mixed mesophytic forest habitat likely is not suitable because the canopy is completely open, or regeneration has progressed to the point that it is not open enough. Also, suitable habitat likely exists in the mature successional stage (not included in the estimate) because of partial disturbances of the canopy. Therefore, habitat abundance is rated as occasional as a best estimate.

Habitat on the MNF - Potential habitat is widespread and nearly contiguous across much of the Forest, but actual suitable habitat is limited to lightly disturbed areas. Such areas tend to be scattered, but the possibility of seed dispersal via deer (Pickering 1989) may serve to connect some patches.

West Virginia Natural Heritage Program records (unpublished data 2003a) show 16 recent element occurrences within the MNF proclamation boundary, several of which consist of multiple subpopulations. Most occurrences are on the Cheat Ranger District and the western part of the Greenbrier Ranger District. Based on these data, the species appears to occur in a substantial minority of the potential habitat. Only three of the known occurrences are on private land. Forest Service occurrences are protected, although lack of disturbance may be an issue for these occurrences.

Threats - Regional threats to RBC include: direct loss of habitat; reduced ground disturbance and permanent loss of disturbed woodlands along streams and terrace areas, habitat fragmentation, competition from non-native plants and altered natural disturbance regime (USDA Forest Service 2001). The clover may have been tied to disturbances made by large herbivores, particularly bison. With the elimination of large herbivores from the range of the clover, not only was the habitat lost but so were potential routes and mechanisms of dispersal (USFWS 1989). An additional threat that has caused decline is reduced fire frequency resulting in the loss of open woodlands (Ostlie 1990). Current knowledge indicates RBC needs slight disturbance to thrive, but the specific types and severity of disturbance are not well understood.

Small Whorled Pogonia (*Isotria medeoloides*)

Small whorled pogonia (SWP) is a federally threatened perennial of the orchid family. Habitat ranges from mixed deciduous or mixed deciduous/coniferous forests to dry, oak or oak-pine forests. Highly acidic, nutrient poor soils may be characteristic of habitat, however with only one site in West Virginia, generalizations are difficult. SWP is characterized by wide population fluctuations from year to year (USFWS 1992a).

Habitat on the MNF - Habitat abundance was rated as common and its distribution considered connected in the SVE. Habitat on the Monongahela was estimated for the SVE as old and mature mixed mesophytic forest, old and mature oak forests, and old and mature oak-pine forests. These habitat types are estimated to cover about 66 percent of the land within the Forest boundary. The fact that the species is very rare suggests that these forests may not accurately represent suitable habitat. The “common” rating is based on the extreme abundance of the mixed mesophytic forest type.

SWP is only known from one location within the Forest boundary. No plants were observed at this location when it was last surveyed in 2002 (West Virginia Natural Heritage Program unpublished data 2003a). This very limited distribution may indicate the existence of a microhabitat preference that is not reflected in the habitat ratings, or it may indicate the action of an unidentified threat. Alternatively, it could be the result of inadequate survey efforts, or a combination of both.

Threats - Habitat destruction is the primary threat to SWP range-wide. Herbivory by deer, and collecting and damage from research activities are secondary threats (USFWS 1992a).

Shale Barren Rockcress (*Arabis serotina*)

Shale barren rockcress (SBRC) is a federally endangered biennial herb found mainly on shale barrens of eastern counties of West Virginia. *Arabis serotina* can be jeopardized by drought, habitat degradation, stochastic events, herbivory and other biotic factors (USFWS 1991b).

Habitat on the MNF - Potential and known habitat within the entire MNF is estimated to be less than 100 acres. Habitat abundance was determined to be rare and distribution patchy through the Species Viability Evaluation process.

West Virginia Natural Heritage Program records (unpublished data 2003a) show 11 element occurrences within the Proclamation boundary, all but one of which is on Forest Service land. Shale barrens on Forest Service land are not likely to be vulnerable to destruction, but occurrences generally have few individuals (NatureServe 2003 accessed 3/23/04, USFWS 1991b) and must be considered somewhat vulnerable to extirpation in light of the possible deer browse threat.

Threats - Regional threats to existing SBRC populations include deer herbivory and invasion of non-native species. Insect pollinators are vulnerable to Dimilin spraying for gypsy moth control. SBRC habitat is generally not under threat from forest management practices.

Virginia Spiraea (*Spiraea virginiana*)

Virginia spiraea is a federally threatened clonal shrub found on damp, rocky banks of larger, high gradient streams. This shrub may also be found at the flood-scoured mouths of side streams, rocky isles, seasonally flooded side channels, and in shrub thickets between river and forest. The shrub may be found in either full sun or shade.

A combination of factors contributes to the rarity of the species, including a very narrowly defined habitat niche that is subject to scouring and flooding, apparent lack of successful sexual reproduction, limited opportunities for colonization, and competition from other species (West Virginia Natural Heritage Program 1991). Most occurrences range-wide are of poor quality and have low viability. It is estimated that there are fewer than 30 different genotypes range-wide (NatureServe 2003 accessed 3/31/04).

Within a watershed, occurrences potentially are connected along streams via water-borne seed dispersal or flood-dispersed vegetative fragments. Populations in different watersheds are isolated from each other. Connectivity could be important for the species' long-term viability because when clones from different localities are grown together, they fruit prolifically and produce viable seed (USFWS 1992b).

Habitat on the MNF - Elevation range for known occurrences in West Virginia is 1000 to 1800 feet. It is not known whether this represents a preference or is an artifact of the species' very limited distribution. Low elevations (less than 2500 feet) on the Forest are limited to the western part of the Cheat District, the eastern part of the Potomac District, the Tygart River valley, the Gauley River valley, and the southern end of the White Sulphur district. For this analysis, the banks of larger streams within these low-elevation areas are presumed to represent potential habitat for Virginia spiraea.

Within the Forest, there is one element occurrence consisting of two subpopulations along the Greenbrier River at the southern edge of the White Sulphur District. Based on this information, the species appears to occupy only a small fraction of the potentially available habitat. Habitat abundance is rated as occasional with a patchy distribution.

Threats - Because Virginia spiraea is primarily a shrub of the riparian ecotone between forested slopes and the rocky shores of high-energy rivers, the factors that most affect the species are those that either eliminate its habitat all together, or curtail the moderate level of flood-scouring it seems to require. It is thought that scouring reduces competition from native and non-native plants that would otherwise out-compete it. Recreational users may pose an additional threat by clearing riverside sites for fishing, camping and rafting. Large scouring floods and competition from native and non-native plant species are threats as well (West Virginia Natural Heritage Program 1991).

Threatened and Endangered Animal Species

The five federally T&E terrestrial animal species on the MNF are: Virginia big-eared bat (*Corynorhinus townsendii virginianus*), Indiana bat (*Myotis sodalis*), West Virginia northern flying squirrel (*Glaucomys sabrinus fuscus*), bald eagle (*Haliaeetus leucocephalus*) and Cheat Mountain salamander (*Plethodon nettingi*). Habitats for these species range from riparian areas to caves, and are described in detail for each species below.

The eastern cougar (*Puma concolor couguar*); gray wolf (*Canis lupis*); and gray bat (*Myotis grisescens*) are currently listed species. However, according to WVDNR records, the last confirmed occurrence of eastern cougar was 1887. Similarly, the last confirmed occurrence of the gray wolf was in 1900, and both species are considered extirpated from West Virginia. There is a single record of gray bat in West Virginia from a winter bat count in Hellhole Cave in 1991. At this time, that occurrence is considered accidental in West Virginia. Due to their lack of occurrence, these species will not be discussed further in this analysis.

<u>Virginia Big-eared Bat (*Corynorhinus townsendii virginianus*)</u>

Virginia big-eared bat (VBEB) was listed as endangered on December 31, 1979. A USFWS Recovery Plan was signed May 8, 1984. The subspecies *virginianus* is a year-round cave obligate species occupying a very limited geography in the central Appalachians. In the mid 1990’s the West Virginia/North Carolina populations numbered more than 13,000 bats. The total population in 1997 was less than twenty thousand (Natureserve 2005). Five West Virginia colony sites have been designated as “critical habitat” for VBEB (Federal Register 1979, USFWS 1984). They are shown in Table TE-1, below. Numerous other caves and abandoned mines in West Virginia have records of hibernating or summering Virginia big-eared bats, with numbers ranging from a single bat to over 1,000.

The WVDNR monitors 10 summer Virginia big-eared bat maternity colonies, many of which have been censused annually since 1983. Two known bachelor colonies are not monitored on an annual basis. The numbers from the summer censuses have shown a generally increasing trend over time, with the overall population trending more toward stability over the last decade (see data in Stihler and Wallace 2005). The initial survey in 1983 recorded 3,213 adult Virginia big-eared bats from eight caves. The most recently reported survey in 2005 recorded 5,990 bats from

10 caves. The highest number recorded in any survey was 6,416 in 1999 (Stihler and Wallace 2005).

Table TE-1. Critical Habitat for the Virginia Big-eared Bat in West Virginia

Cave	Ownership	Cave Use	Protection
Cave Hollow/Arbogast	NFS lands	Maternity, Hibernaculum	Gated and fenced
Cave Mountain	NFS lands	Maternity, Hibernaculum	Gated
Hellhole Cave	Private but within Forest proclamation boundary	Hibernaculum	Fenced
Hoffman School	Private and within 6 miles outside Forest boundary	Maternity, Hibernaculum	Gated
Sinnit/Thorn Cave	Private and more than 6 miles outside Forest boundary	Maternity, Hibernaculum	Gated

Virginia big-eared bats are not migratory; however, they may move among different caves and mines during the summer and fall. The longest recorded movement is 40 miles (Barbour and Davis 1969). They begin to return to winter hibernacula in September, but continue to feed during warm evenings. By December, they return to hibernation.

Male and female Virginia big-eared bats winter hibernate singly or in mixed clusters within caves or mines. In spring, females form smaller maternity colonies. Males move to different cave areas and may form bachelor colonies or remain solitary. Nocturnal activities in maternity colonies vary as the maternity season progresses. During May and most of June, when females are pregnant, the colony remains outside the cave most of the night; however, birth takes place within caves. After birth in late June and July, the females' nightly emergent behavior depends on the needs of their young. When the young are weaned in August, nursery colonies disperse.

Virginia big-eared bats feed predominantly on moths, but also on beetles, true flies, mosquitoes, bees, wasps, and ants (USDA Forest Service 2001). Virginia big-eared bats generally forage near their summer caves. Virginia big-eared bats have been documented foraging up to 6 miles from cave entrances (Stihler 1995), and foraging areas may include lightly grazed pastures, fields, and forest edges.

Use of different foraging habitats among Virginia big-eared bat populations in different locations appears to be a response to different habitat availabilities and demonstrates the species' flexibility to local conditions (Adam et al. 1994). Geographically isolated Virginia big-eared bat populations have been observed using different foraging habitats (Adam et al. 1994, Buford and Lacki 1995). In Virginia, the bats have been documented foraging over open pastures, corn and alfalfa fields, and around tree crowns, while Virginia big-eared bats in a forested landscape in Kentucky have been observed foraging in forested habitats.

Habitat within the 6-mile-radius foraging areas around West Virginia hibernacula and summer colonies is very diverse. The majority of the foraging areas are not on National Forest land, but rather private agricultural fields. Limited radio-tracking data from West Virginia have documented female Virginia big-eared bats foraging over hay fields, forests, old fields, and riparian corridors (Stihler 1994a). Most activity has been observed in a mosaic of these habitats rather than large areas of one habitat type. Herbaceous vegetative structure may be an important foraging habitat component.

Habitat on the MNF - Important habitat for the Virginia big-eared bat on the MNF consists of identified summer colony sites, hibernation sites, and foraging areas (6 mile radius from hibernacula and summer colonies). Under the 1986 Plan as amended, hibernacula and summer colonies are managed through Forest Plan direction for Opportunity Area 837.

Twenty-three caves with Virginia big-eared bat records lie within the Forest proclamation boundary. Six of these caves harbor concentrations of dozens to hundreds or thousands of individuals during the winter, summer, or both. The remaining caves typically harbor a few bats or are based on old records of a few individuals. Of the 23 occupied caves within the proclamation boundary, eight are located on NFS lands. Three of these eight (Cave Hollow/Arbogast, Cave Mountain, and Peacock) typically harbor major concentrations of dozens to over a thousand individuals. These three caves are discussed in greater detail below. In addition to the 23 occupied caves in the proclamation boundary, 14 caves with Virginia big-eared bat records lie within 6 miles outside the proclamation boundary. Table TE-2 summarizes the 37 Virginia big-eared bat caves that are within the proclamation boundary or within 6 miles outside the boundary.

Table TE-2. Virginia Big-eared Bat Hibernacula within the MNF Proclamation Boundary or Within 6 miles Outside the Boundary

Cave Name	County	Major or Minor[1]	Location	Colony Type	Gated or Fenced
Cave Hollow/Arbogast	Tucker	major	NFS land	maternity and hibernaculum	yes
Peacock Cave	Grant	major	NFS land	maternity and hibernaculum	no
Cave Mountain Cave	Pendleton	major	NFS land	maternity and hibernaculum	yes
Big Springs Cave	Tucker	minor	NFS land	hibernaculum	yes
Bowden Cave	Randolph	minor	NFS land	hibernaculum	no[2]
Harper Trail Cave	Randolph	minor	NFS land	hibernaculum	no
Mill Run Cave #1	Pendleton	minor	NFS land	unknown	no
Mill Run Cave #2	Pendleton	minor	NFS land	unknown	no
Hellhole Cave	Pendleton	major	within proclamation boundary, not NFS land	hibernaculum and bachelor	yes
Schoolhouse Cave	Pendleton	major	within proclamation boundary, not NFS land	maternity and hibernaculum	yes
Mystic Cave	Pendleton	major	within proclamation boundary, not NFS land	maternity	no
Acorn Cave	Tucker	minor	within proclamation boundary, not NFS land	unknown	no

Cave Name	County	Major or Minor[1]	Location	Colony Type	Gated or Fenced
Izaak Walton Cave	Randolph	minor	within proclamation boundary, not NFS land	hibernaculum	no
Stewart Run Cave	Randolph	minor	within proclamation boundary, not NFS land	hibernaculum	no
Sinks of Gandy	Randolph	minor	within proclamation boundary, not NFS land	hibernaculum	no
Spring Cave	Randolph	minor	within proclamation boundary, not NFS land	hibernaculum	no
Alpena Cave number 1	Randolph	minor	within proclamation boundary, not NFS land	unknown	no
Alpena Cave number 2	Randolph	minor	within proclamation boundary, not NFS land	unknown	no
Aqua-Terra Cave	Randolph	minor	within proclamation boundary, not NFS land	hibernaculum	no
Cedar Hill Cave	Grant	minor	within proclamation boundary, not NFS land	unknown	no
Smoke Hole Cave	Pendleton	minor	within proclamation boundary, not NFS land	unknown	no
Mill Run Cave	Tucker	minor	within proclamation boundary, not NFS land	unknown	no
Warner's Cave	Pendleton	minor	within proclamation boundary, not NFS land	unknown	no
Minor Rexrode Cave	Pendleton	major	within 6 miles outside proclamation boundary	bachelor and hibernaculum	yes
Hoffman School Cave	Pendleton	major	within 6 miles outside proclamation boundary	maternity and hibernaculum	yes
Lambert Cave	Pendleton	major	within 6 miles outside proclamation boundary	maternity	yes
Mill Run Cave	Pendleton	major	within 6 miles outside proclamation boundary	maternity and bachelor	no
Elkhorn Mountain Cave	Grant	major	within 6 miles outside proclamation boundary	bachelor	no
Trout Cave	Pendleton	minor	within 6 miles outside proclamation boundary	hibernaculum	no
New Trout Cave	Pendleton	minor	within 6 miles outside proclamation boundary	hibernaculum	no
Gale Warner's Cave	Pendleton	minor	within 6 miles outside proclamation boundary	maternity (historic)	no
Flute Cave	Pendleton	minor	within 6 miles outside proclamation boundary	autumn transition	no
Brook Stemple Cave	Preston	minor	within 6 miles outside proclamation boundary	unknown	no
Keys Cave	Pendleton	minor	within 6 miles outside proclamation boundary	hibernaculum	no
Rexrode Cave	Pendleton	minor	within 6 miles outside proclamation boundary	unknown	no
Seneca Caverns	Pendleton	minor	within 6 miles outside proclamation boundary	unknown	no
Sites Cave	Pendleton	minor	within 6 miles outside proclamation boundary	unknown	no

[1]Major hibernacula typically host dozens, hundreds, or thousands of bats, while minor hibernacula host very few bats in most years.
[2]Part of the main passage of Bowden Cave is blocked by a safety barricade, but the part of the cave that typically hosts Virginia big-eared bats is not gated or fenced.

Since 1992, which was the first year in which all of the currently known major summer colonies were surveyed, the three major caves on NFS land have accounted for approximately 30 to 40 percent of the total number of individuals in the surveyed West Virginia maternity colonies. The total number of individuals in the three caves has generally exhibited a stable to slightly upward trend since 1989 (Figure 3), reflecting the increasing numbers in Cave Hollow/Arbogast and Peacock Cave and the decreasing numbers in Cave Mountain Cave.

Based on the 6-mile radius for foraging, there are an estimated 604,000 available foraging acres within the MNF proclamation boundary. Foraging areas within the proclamation boundary are very diverse. A sizeable minority of the land within foraging areas is private agricultural land. Other non-NFS land uses within the foraging areas include timber harvests, strip mining, limestone/rock quarries, State Park, and National Wildlife Refuge land. Characterization of habitat use is difficult due to the paucity of telemetry data and the fact that much of the available habitat is on private land, which has no stand data. NFS land contains approximately 324,000 acres of Virginia big-eared bat foraging area. Limited telemetry data from NFS land recorded Virginia big-eared bats foraging in mixed oak and pine-oak stands (Stihler 1994a).

Threats - Cave dwelling bats are particularly at risk due to disturbances within the cave environment. Disturbances (recreation or commercial use, changes in cave microclimate, and natural disasters) during hibernation and maternity rearing can have devastating affects to bat populations. Removal of buildings that are being used as roosting or resting areas may also be a threat.

In addition to direct effects to roosting individuals, Virginia big-eared bats may be indirectly vulnerable to activities that affect foraging. Herbaceous foraging habitats such as old fields, hay fields, and pastures that are not maintained may be degraded or eliminated by reforestation. Insecticides, particularly those used for gypsy moth, may adversely affect the food supply (Sample and Whitmore 1993).

Wind turbines used to generate electric power are a relatively new threat to bats in West Virginia. Although no mortality of endangered bats has been documented, wind turbines on private land in Tucker County were estimated to have killed over 2,000 bats of various species during the period 4 April through 11 November 2003 (Curry and Kerlinger, LLC 2004). During a six-week search period in the summer of 2004, the same turbines were estimated to have killed between 1,364 and 1,980 bats (Arnett et al. 2005). These windmills are not located near any Virginia big-eared bat hibernacula. It is reasonable to assume that Virginia big-eared bats could be killed if wind turbines were to be constructed closer to hibernacula.

Indiana Bat (*Myotis sodalis*)

Indiana bat was listed as endangered on March 11, 1967. The original 1983 USFWS Recovery Plan is under revision and has not been finalized. However, a draft of the revised version is often used to provide guidance for management activities (USFWS 1999).

Indiana bat distribution is generally associated with limestone karst in the eastern U.S. (Menzel et al. 2001). Indiana bats occupy distinct habitat types: mines and caves are used for hibernation, while forested areas are used for summer foraging, roosting, and fall swarming.

Wintering colonies require very specific climatic regimes in caves or mines (Menzel et al. 2001). Habitat conditions are so specific that more than 85 percent of the range-wide bat populations hibernate in just 9 caves in Indiana, Kentucky and Missouri (USFWS 1999). Indiana bats hibernate in compact clusters containing males and females; however, females enter hibernation earlier in autumn than do males.

Summer foraging and maternity roosting habitat is difficult to quantify at a range-wide, regional, or local level due to variability of known maternity roost sites and lack of knowledge about landscape-scale habitat characteristics. However, based on a review of range-wide data, Romme et al. (1995) constructed a habitat suitability model that suggests that optimal canopy closure for roosting ranges from 60 to 80 percent. Romme et al. (1995) further described optimal roosting habitat as having an abundance of large trees and snags (>8.7 inches DBH) and a relatively open understory. Tree structure, specifically the availability of exfoliating bark or cavities that provide roost space, is a critical characteristic for roost trees. Indiana bats use isolated trees in openings as roost trees (Kurta et al. 1993), and they may switch between shaded and unshaded roost trees depending on weather conditions (Callahan et al. 1997; Menzel et al. 2001) and physiological requirements associated with thermal regulation. Indiana bat maternity colonies generally use both primary and alternate roost trees (Britzke et al. 2003).

Most known maternity sites have been located in forested tracts in agriculturally dominated landscapes in Missouri, Iowa, Indiana, and Illinois (USFWS 1999). A small number of maternity colonies recently have been reported in heavily forested mountainous areas of western North Carolina, eastern Tennessee (Britzke et al. 2003), and West Virginia. Colonies generally are found under the loose bark of dead or dying trees, but roosts have been found in tree cavities (Gardner et al. 1991).

Menzel et al. (2001) suggested that foraging occurs in riparian areas, upland forests and woodlots, and over ponds. Information from limited radio telemetry work on the MNF in recent years supports this assessment of foraging habitat use. Insects are caught and consumed while the bats are flying. Prey insects include moths, beetles, flies, caddis flies, stoneflies, lacewings, and ants. Moths and beetles are the largest part of most diets.

Most studies of Indiana bat foraging habitat use have been observational in nature. The few that have tried to investigate preference and avoidance of specific habitats were subject to potential methodological biases that raise questions about the validity of the results (see studies reviewed in Menzel et al. 2001 and USFWS 1999). Based on a review of range-wide data, Romme et al.

(1995) constructed a habitat suitability model that suggests that optimal canopy closure for foraging ranges from 50 to 70 percent. However, few data are available to demonstrate a clear preference or avoidance of particular forest canopy conditions.

In addition to forest canopies, Indiana bats also are known to forage along forest edges, in early successional areas, and along strips of trees extending into more open habitat, but drinking water must be available near foraging areas (Romme et. al. 1995). Large open pastures or croplands, large areas with less than 10 percent canopy cover, and stands with large, unbroken expanses of young, even-aged forests are avoided or are rarely used (Romme et al. 1995).

Indiana bats begin pre-hibernation swarming near caves as early as August, and continue swarming through October or November, depending upon local weather conditions. Swarming entails congregating around hibernacula prior to hibernation and flying into and out of cave entrances from dusk to dawn (Kiser and Elliot 1996). This is a biologically important period because during this time, bats mate and replenish fat reserves prior to hibernating (USFWS 1983).

Habitat on the MNF - The area of influence for Indiana bat on the MNF is currently recognized as four distinct areas:
1) Maternity sites are evidenced by lactating females or juveniles discovered prior to August 15.
2) Hibernacula are the caves or mines that are occupied by hibernating Indiana bats.
3) Key areas provide mature forest habitat near hibernacula. A key area is at least 150 acres in size, and, as appropriate, includes 20 acres of older growth forest and 130 acres of mature forest located as close to the cave as possible.
4) Primary range, which includes summer foraging, roosting, and fall swarming areas, is defined as all areas within 5 miles of hibernacula.

Under the 1986 plan as amended, maternity sites, hibernacula, and key areas are managed under Opportunity Area 838, whereas primary range is managed under a combination of MPs 6.3, 5.0, and 6.2.

West Virginia is within the Indiana bat's eastern maternity range, but not within its core range. Until recently, nighttime temperatures on most of the MNF were thought to be too cold to support numerous maternity colonies (Stihler pers. comm. 1999, Tolin pers. comm. 1999). Despite extensive summer surveys throughout West Virginia and the MNF, prior to summer 2003 there were no confirmed maternity colonies in the state. However, in 2003 a maternity colony was discovered in the southern part of West Virginia. This colony was confirmed again in 2004 (Chapman 2005). Also in 2004, a confirmed maternity colony was located on private land within the MNF proclamation boundary in Tucker County. That same summer, a male Indiana bat was tracked to a roost tree on the MNF in Pendleton County that contained 23 bats. Maternity activity is suspected at this site, though not confirmed because no lactating females or juveniles were captured.

Potential summer/maternity roosting and foraging habitat is widely available as the MNF is over 95 percent forested, with nearly 90 percent of the forested area being more than 60 years old. Given the average growth rates on the MNF, the stands that are over 60 years old most likely have a mean diameter in excess of the 8.7 inches needed for quality roosting habitat. Trees exhibiting roosting characteristics—such as shagbark (*Carya ovata*) and bitternut hickory (*Carya cordiformis*), red (*Quercus rubra*) and white oak (*Quercus alba*), sugar maple (*Acer saccharum*), white (*Fraxinus americana*) and green ash (*Fraxinus pennsylvanica*), and sassafras (*Sassafras albidum*)—are plentiful throughout the Forest. Snag abundance currently is below optimum levels in most areas, but snags do contribute to summer roosting habitat quality. Field observations suggest that most of these stands have closed or nearly closed canopies, which may be denser than optimal for roosting and foraging. As aging continues, canopy gaps from dying trees will become more prevalent, reducing the overall canopy cover. However, because less than 5 percent of forested acreage currently exceeds 120 years old, gap dynamics are not likely to be widespread during the first decade or two of the planning horizon.

Hibernating Indiana bats have been observed in many West Virginia caves, with numbers ranging from a single observation to populations over 11,000. The largest West Virginia population is found in Hellhole Cave in Pendleton County. This cave is designated as Priority Two "Critical Indiana Bat Habitat" (Federal Register 1976). It lies on private land within the MNF's proclamation boundary. Over the years it has been censused, Hellhole's wintering population has gone from 210 Indiana bats in 1984 to 11,890 in 2005.

Based on recent WVDNR surveys and data in MNF files, 15 Indiana bat hibernacula are located within the MNF proclamation boundary (Stihler et al. 2001; Stihler and Wallace 2002, 2003, 2004, 2005; USDA Forest Service unpublished data). Seven of these are major hibernacula that regularly harbor dozens to hundreds or thousands of hibernating Indiana bats. The other eight typically host a few individuals or are based on old records of a few individuals. Six of the 15 hibernacula within the proclamation boundary have all or most of their entrances on NFS lands. Of these six, two (Big Springs and Cave Hollow/Arbogast) regularly host dozens to hundreds of Indiana bats. Eleven additional hibernacula lie within 5 miles outside the proclamation boundary. At the programmatic level, key areas have been defined around hibernacula within and near the proclamation boundary, although additional analysis likely will be necessary to refine these at the site-specific level. Table TE-3 presents an information summary for the hibernacula that lie within the proclamation boundary or within 5 miles outside of the boundary.

Of the six hibernacula on NFS land, Big Springs, Cave Hollow/Arbogast, and Two Lick Run are closed to public entry during hibernation season. Big Springs and Cave Hollow/Arbogast have additional protection from fences or gates. Cave Mountain is gated to protect a Virginia big-eared bat maternity colony, but the cave remains open to the public during hibernation season.

Table TE-3. Indiana Bat Hibernacula Within the MNF Proclamation Boundary or Within Five Miles Outside the Boundary

Cave Name	County	Major or Minor Hibernaculum[1]	Location	Gated or Fenced
Big Springs Cave	Tucker	major	NFS land	yes
Cave Hollow/Arbogast Cave	Tucker	major	NFS land	yes
Two Lick Run Cave	Randolph	minor	NFS land	no

Cave Name	County	Major or Minor Hibernaculum[1]	Location	Gated or Fenced
Bowden Cave System	Randolph	minor	NFS land	no[2]
Coal Run Cave	Tucker	minor	NFS land	no
Cave Mountain Cave	Pendleton	minor	NFS land	no[3]
Hellhole Cave	Pendleton	major	within proclamation boundary, not NFS land	yes
Izaak Walton Cave	Randolph	major	within proclamation boundary, not NFS land	no
Stewart Run Cave	Randolph	major	within proclamation boundary, not NFS land	no
Falling Spring Cave	Randolph	major	within proclamation boundary, not NFS land	no
Tub Cave	Pocahontas	minor	within proclamation boundary, not NFS land	no
Schoolhouse Cave	Pendleton	minor	within proclamation boundary, not NFS land	yes
Cass Cave	Pocahontas	minor	within proclamation boundary, not NFS land	no
Simmons-Mingo Cave	Randolph and Pocahontas	minor	within proclamation boundary, not NFS land	no
Smoke Hole Cave	Pendleton	minor	within proclamation boundary, not NFS land	no
Martha’s Cave	Pocahontas	major	within 5 miles outside proclamation boundary	no
Snedegar’s Cave	Pocahontas	major	within 5 miles outside proclamation boundary	no
Fortlick Cave	Randolph	major	within 5 miles outside proclamation boundary	no
Trout Cave	Pendleton	major	within 5 miles outside proclamation boundary	no
Lobelia Saltpeter Cave	Pocahontas	minor	within 5 miles outside proclamation boundary	no
Bob Gee Cave	Greenbrier	minor	within 5 miles outside proclamation boundary	no
Gooseberry Cave	Randolph	minor	within 5 miles outside proclamation boundary	no
Higgenbothams Cave #1	Greenbrier	minor	within 5 miles outside proclamation boundary	no
Higgenbothams Cave #2	Greenbrier	minor	within 5 miles outside proclamation boundary	no
Higgenbothams Cave #3	Greenbrier	minor	within 5 miles outside proclamation boundary	no
Higgenbothams Cave #4	Greenbrier	minor	within 5 miles outside proclamation boundary	no

[1]Major hibernacula typically host dozens, hundreds, or thousands of bats, while minor hibernacula host very few bats in most years.
[2]Part of the main passage of Bowden Cave is blocked by a safety barricade, but the part of the cave that typically hosts Indiana bats is not gated or fenced.
[3]Cave Mountain Cave is gated to protect a Virginia big-eared bat maternity colony, but the gate remains open during the hibernation season when the cave is used by Indiana bats.

Primary range around all the hibernacula within the proclamation boundary and within 5 miles outside the boundary includes an estimated 228,000 acres of NFS land. Stihler (1996) found that Indiana bat males foraged and day roosted near hibernacula (within 3.5 miles, or 5.6 km) throughout summer. He observed that these males often switched roost trees from day to day, roosting in trees near ridge tops. Based on Stihler's work, a 5-mile zone around hibernacula is considered primary range for those Indiana bats that stay around the caves in the summer. Primary range also contains the areas around the caves that are used for fall swarming. The NFS land in these 5-mile zones is similar to habitat in the rest of the Forest, namely mostly forested areas over 60 years old and having dense canopies.

Threats - The population of this species in the core of its range appears to have declined over the long term despite protection efforts at all known major hibernacula. Causes of the decline are not known; however, researchers are focusing on impacts from surrounding land uses, pesticides, heavy metals, and genetic variability (see reasons for decline listed in USFWS 1999). In contrast, hibernacula monitoring in West Virginia shows that estimated populations have increased since the early 1980s. Most significant caves are gated or fenced, which has protected Indiana bat populations and likely has been responsible for their increases.

Human disturbance of hibernating bats and cave vandalism are two primary factors contributing to Indiana bat declines. Other causes include natural disasters, habitat alteration, chemical contamination, historic collecting and handling, poorly designed and installed cave gates, cave commercialization, insecticides and natural predators. The effects of timber harvesting on Indiana bat foraging patterns is unknown, especially during the spring and fall swarm and during summer (Menzel et al. 2001).

Disturbance of maternity colonies also is a potential threat, especially if the disturbance involves removing or damaging maternity roost trees. Also, excessive noise (e.g., construction equipment) near maternity roosts is known to disturb maternity colonies (Garner and Gardner 1992; cited in Evans et al. 1998).

Wind turbines used to generate electric power are a relatively new threat to bats in West Virginia. Although no mortality of endangered bats has been documented, wind turbines on private land in Tucker County were estimated to have killed over 2,000 bats of various species during the period 4 April through 11 November 2003 (Curry and Kerlinger, LLC 2004). During a six-week search period in the summer of 2004, the same turbines were estimated to have killed between 1,364 and 1,980 bats (Arnett et al. 2005). These windmills are not located near any Indiana bat hibernacula. It is reasonable to assume that Indiana bats could be killed if wind turbines were to be constructed closer to hibernacula.

West Virginia Northern Flying Squirrel (*Glaucomys sabrinus fuscus*)

West Virginia northern flying squirrel (WVNFS) is a nocturnal sciurid that inhabits disjunct high-elevation "islands" in the central Appalachians of eastern West Virginia and western Virginia (Menzel et al. 2004). In 1985, the USFWS added the West Virginia northern flying squirrel to the endangered species list. An Appalachian Northern Flying Squirrels Recovery Plan was released September 24, 1990. A Recovery Plan Update was signed on September 6, 2001 which included a Guideline for Habitat Identification and Management for *Glaucomys sabrinus fuscus* (USFWS 2001).

Throughout their range, northern flying squirrels use both tree cavities and leaf nests. Leaf nests and cavities serve a variety of purposes including diurnal sleeping sites, feeding stations during nocturnal foraging and as nests for raising young (Menzel et al. 2004). The squirrels apparently subsist on lichens and fungi, but also eat seeds, buds, fruit, staminate cones, and insects (USFWS 2001). Fecal samples of WVNFS indicate the most common foods eaten were lichens, fungi (mostly underground/hypogeous), pollen, and insects (Mitchell 2001).

In the central Appalachians, WVNFS commonly prefer conifer/hardwood ecotones or mosaics dominated by red spruce and fir with hemlock (*Tsuga canadensis*), beech (*Fagus grandifolia*), yellow birch (*Betula allegheniensis*), sugar (*Acer saccharum*) or red maple (*Acer rubrum*), and black cherry (*Prunus serotina*) associates. WVNFS have also been captured in northern hardwoods with conifer understory (Stihler et al. 1995). Northern flying squirrels have been captured in stands of various ages, understories, densities, and species composition, but most have been in moist forests with some widely-spaced, mature trees, and abundant standing and downed snags (USFWS 2001, WVDNR 1997), usually with some conifer (spruce, hemlock, fir) present (Stihler 1994b). These habitats seem well suited to WVNFS' gliding locomotion, cavity nest requirements, and reliance on wood-borne fungi and lichens for food (USFWS 1990).

Habitat on the MNF - Under the 1986 Forest Plan as amended, suitable habitat for WVNFS is managed under MP 8.0/Opportunity Area 832. Suitable habitat is identified and mapped consistent with the Guidelines for Habitat Identification and Management found in the updated *Appalachian Northern Flying Squirrels Recovery Plan* (USFWS 2001). A map of suitable habitat is collaboratively produced between the MNF, USFWS and WVDNR and is reviewed and refined at the project level. All mapped suitable habitat is assumed to be occupied by WVNFS, and emphasis is placed on protecting this habitat. The current version of the map shows approximately 150,000 acres of suitable habitat on NFS lands.

The MNF is believed to contain a large majority of the range-wide habitat for the WVNFS (Stihler pers. comm. 1999). There have been 1,180 documented captures in West Virginia through November 2005; 1,011 have occurred on MNF lands. In general, almost all West Virginia northern flying squirrel captures in West Virginia have been associated with red spruce and mixed spruce/northern hardwood forest types (Stihler et al. 1995).

Surveys conducted to date have documented the range of the species throughout much of the higher elevations of the Forest (USDA Forest Service unpublished data), but data have not been sufficient to determine population levels or trends.

Threats - Almost all of West Virginia's high-elevation spruce forest was cut during the railroad logging era from the 1880s to the 1930s. While red spruce regenerated in some areas, fires and soil disturbance that followed logging favored hardwood regeneration in many areas, such that spruce forest within the MNF proclamation boundary now covers a small fraction of its estimated original extent (see Terrestrial Ecosystem Diversity section of EIS Chapter 3).

Beyond direct habitat changes, historical logging also may have favored WVNFS competitors and pathogens via hardwood range expansion. WVNFS may be displaced by the more aggressive southern flying squirrel (*G. volans*) in certain overlapping hardwood habitats. The southern flying squirrel also may transmit the parasite *Strongyloides robustus*, which can be fatal to northern flying squirrels (USFWS 2001).

The greatest current threat to WVNFS is habitat destruction, fragmentation, or alteration. Negative habitat alterations are associated with forest clearing, mineral extraction, and residential/resort development. Because the 1986 Forest Plan as amended contains habitat protections, these threats occur primarily on private land. Possible future declines in spruce forest due to atmospheric deposition of acid and heavy metals threaten to further reduce the range and quality of remaining conifer-hardwood habitats.

Cheat Mountain Salamander *(Plethodon nettingii)*

The Cheat Mountain salamander was listed as threatened on August 18, 1989. A Recovery Plan was released on July 25, 1991 (USFWS 1991a). Critical habitat has not been designated.

The Cheat Mountain salamander is a relict species with isolated populations (Pauley 1997, Kramer et al. 1993). It is geographically restricted to high-elevation forests containing a red spruce component and mixed deciduous forests with a *Bazzania*-dominated forest floor (Pauley 1997). The species' entire range is limited to the higher portions of the Allegheny Mountains in northeastern West Virginia (Pauley 1997).

This plethodontid (lungless) salamander requires microhabitats with high relative humidity or moisture, as respiration occurs through the skin. Old, structurally complex forests are more likely than young forests to provide the necessary moist, stable microenvironment (USDA Forest Service 2001).

Habitat on the MNF - High potential Cheat Mountain salamander habitat on NFS land is estimated at over 100,000 acres; surveys have documented occurrences at scattered locations within that habitat (USDA Forest Service unpublished data). A few known occurrences lie outside mapped high potential habitat. Cheat Mountain salamanders are generally confined to high-elevation areas in the northern and central portions of the Forest. While this species is typically associated with spruce, studies have not conclusively established a preference for any one forest type. Recent surveys have expanded the known range of the Cheat Mountain salamander to about 935 square miles, with about 65 of the 85 known occurrences located on the MNF.

Threats - The extensive logging of spruce around the turn of the century is the most likely cause of decline for this species. Competition from other similar plethodontids, genetic isolation of populations, habitat degradation (e.g., acid deposition), habitat fragmentation, and habitat disturbance all continue to contribute to the limited occurrence of the species (Pauley 1980, USFWS 1991a).

Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle was first listed on March 11, 1967. On July 12, 1995, the USFWS reclassified the bald eagle from endangered to threatened throughout the lower 48 states (Federal Register 1995). De-listing has been proposed based on substantial population increases in recent decades.

Bald eagles are closely associated with large bodies of water with abundant fish populations during both the breeding and non-breeding season (Buehler 2000, DeGraaf and Yamasaki 2001). Bald eagles forage along rivers, large streams, and lakes, where they perch in trees near the water's edge and wait for fish or waterfowl to come along. The proportional importance of the various food items may vary regionally.

Breeding most often occurs within one mile of the water bodies that provide primary food sources (USFWS 1990a). Nests are built in super-canopy trees approximately 100 yards from the nearest forest edge (Cline 1985). Overall, bald eagles prefer areas with limited disturbance from humans (Buehler et al. 1991), although anecdotal reports suggest that some individuals or pairs can become habituated to various levels of human activity (e.g., Stihler and Wallace 2002, Stihler and Wallace 2004).

Habitat on the MNF – Although riparian forests are widespread and common on the MNF, large bodies of water that are suitable for eagle foraging are limited. The Smoke Hole area, in along the South Branch of the Potomac River, provides good forage and nest habitat. Although the MNF has no large lakes or impoundments, smaller lakes such as Buffalo Lake, Summit Lake, Spruce Knob Lake, and Lake Sherwood provide potential habitat. Lake Moomaw on the George Washington National Forest is a larger lake located about 5 miles from the MNF's southeastern border. Bald eagles have nested at this lake. The small lakes on the MNF may be used primarily by non-breeding eagles traveling south from northeastern breeding areas, or north from southern breeding areas.

Two recent bald eagle nest sites are known from the MNF, both in the Smoke Hole vicinity. One of these nest sites has consistently fledged young for a number of years, while the other was first discovered during the 2003 nesting season. Both sites are in the Spruce Knob – Seneca Rocks National Recreation Area, and one is located in a remote backcountry area of the NRA.

Threats – Pesticide (DDT and DDE) and heavy metal accumulations reduced bald eagle reproduction and caused most of the historic population decline (Cline 1985). Suspension of DDT use in 1972 has resulted in substantial population increases, and bald eagle numbers are no longer declining (hence the proposed de-listing).

Direct human disturbance, including intentional shooting, has also contributed to historic population declines. Although the bald eagle population in West Virginia is increasing, several eagles have been shot in West Virginia in the past decade. Shootings and disturbance at nest sites still affect eagles in this state (Stihler and Wallace 2003, 2004, 2005). Current MNF management activities, including recreation, do not appear to be negatively affecting bald eagle nesting at either MNF site, as young are being fledged annually.

Habitat destruction and degradation via shoreline development, recreational waterway and shoreline use, and non-point and point source water pollution still threaten bald eagles in some areas (Federal Register 1995).

ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Below are the mitigation or management requirements common to all alternatives that will be used to protect threatened and endangered species. Resource protection methods come in the form of laws, regulations, policies, FSM and FSH direction, Forest Plan direction, and Forest Plan implementation strategies.

Laws, Regulations, and Policies

Table TE-4. Major Laws and Regulations Influencing Management and Protection of Threatened and Endangered Species on the Forest

Act/Law/Regulation/Policy	Date	Law/CFR/FSM/FSH Number
Organic Administration Act	06/04/1897	30 Stat. 11
Weeks Law	03/01/1911	P.L. 61-435
Endangered Species Act	1973	16 U.S.C. 1531
Interagency Cooperation on Consultation	06/03/1986	50 CFR 402
Interagency Cooperation Under the Endangered Species Act	07/01/1994	59 FR 166 34271-34275
Forest Service Manual, Wildlife, Fish, and Sensitive Plant Habitat Management	Updated as needed	FSM 2600
Forest Service Manual, Threatened, Endangered, and Sensitive Plants and Animals	Updated as needed	FSM 2670
Forest Service Handbook, Wildlife, Fish, and Sensitive Plant Habitat Management	Updated as needed	FSH 2600
Forest Service Handbook, Threatened, Endangered, and Sensitive Plants and Animals	Updated as needed	FSH 2670

One main law governs the management of TEP species on National Forest System lands – the Endangered Species Act of 1973. National laws and regulations have also been interpreted for implementation in Forest Service Manuals, Handbooks, and Regional Guides. Some of the more influential laws, regulations, and policies governing TEP species and habitat management on federal lands are referenced in Table TE-4.

Forest Plan Direction

Forest Plan direction for the management and protection of threatened and endangered species occurs at the Forest-wide level. The 1986 Forest Plan had relatively little direction for T&E species until a Threatened and Endangered Species Amendment was adopted in 2004. Forest-wide direction in the Revised 2006 Plan incorporates and modifies the 2004 amendment direction, and it has been expanded to include a separate section for Threatened, Endangered, and Proposed (TEP) Species with additional goals, and a clearer description of desired conditions. Objectives, standards, and guidelines have also been rewritten in some instances to provide concise and clearer direction, and better integration between protection and management of TEP species habitat and other resources. Some direction from the 1986 Plan as amended has been removed, including items that were process-oriented, or repeated existing law or policy, or that conflicted with other resource management.

The 2006 Forest Plan also includes threatened and endangered species in the Forest Integrated Desired Conditions. The desired condition is for ecosystems on the Forest to support species diversity, with emphasis on maintaining or restoring populations of game and non-game wildlife and fish; threatened, endangered, proposed, and sensitive species; and rare plant communities.

Forest Plan Implementation

Any proposed project on the Forest that may affect listed species or their habitats would follow Forest Plan management direction for the protection of TEP species and their habitats. In addition, the ESA Section 7 Consultation process would be followed. Proposed projects would be evaluated and implemented according to the following sequence of activities:

- Determine whether potential habitat is present in the area to be affected.
- Determine the type and amount of suitable habitat in the project area.
- When necessary and practical for evaluating effects, conduct surveys for TEP species with potential habitat in the area to determine their presence, absence, distribution, or other relevant population characteristics. When surveys are not necessary or practical, assume presence within suitable habitat.
- Analyze potential effects of project activities on TEP species and their habitats.
- Identify any measures needed to avoid or reduce effects to TEP species and their habitats.
- Document and disclose analysis results and impact avoidance/reduction measures through the NEPA process.
- Consult informally with USFWS, and submit a biological assessment with a determination of effects for their concurrence.
- In the case of a likely to adversely affect determination, initiate formal consultation with USFWS.
- Integrate any terms and conditions from the resulting USFWS biological opinion as part of project implementation.

During and after project implementation, monitoring may also be conducted to validate the implementation and effectiveness of project design or impact avoidance/reduction measures.

General Effects to T&E Plant Species

Running Buffalo Clover (RBC)

Effects from Mineral Operations - Federal and private owned mineral development may occur within RBC habitat, but development is not expected to be extensive or vary much by alternative (see Mineral Resources section). By far the major activity that could affect this species is disturbance related to gas development (well sites, roads, pipelines). On average, each well site is approximately 15.5 acres, with associated roads and pipelines that create narrow linear openings and ground disturbance. On average each gas well site includes a 2 acres of opening, 2 acres of access roads, and 11.5 acres of pipeline. Effects could be both negative and positive. Negative effects could occur if individuals or populations are directly eliminated from the disturbance site; however, site-specific surveys prior to operations would greatly reduce this potential. Activities would also provide ground disturbance that could allow nearby populations to expand their numbers.

Effects from Range Activities – RBC habitat would not be affected by continued range management activities, and range management activity would not vary by alternative. No new range areas are expected to be created. Some pastures may include potential habitat if they include forested areas and are on soils derived from limestone. Cattle paths may create habitat for RBC similar to pre-settlement conditions found on game trails. Negative impacts could include herbivory of RBC by cattle and positive impacts could include spreading seeds by the animals.

Effects from Fire-related Activities – Fire suppression activities are not expected to vary by alternative, nor can it be predicted where these activities would occur. Effects could be both negative and positive. Negative effects could occur if individuals or populations are directly eliminated from the disturbance site. Activities would also provide ground disturbance that could allow nearby populations to expand their numbers. However, wildfire and fire suppression activities are currently at fairly low levels on the Forest, and they are not expected to increase dramatically over the short term.

Prescribed fire is allowed within most areas of the Forest. Site-specific burn plans would be completed at the project level for each burn, and these plans would be designed to mitigate any potential adverse effects on T&E species. Prescribed fire is currently limited to 300 acres per year by the Forest's Incidental Take Statement for Indiana bat, but Alternatives 2, 2M, and 4 would increase this amount by as much as tenfold. Potential direct effects to RBC could be both positive and negative. Fire line construction could remove individuals if surveys are not made before construction. Prescribed burning itself is an attempt to re-introduce an ecosystem component that would create the open conditions favored by RBC. Change in fire regime is considered a threat to RBC because of habitat loss.

Effects from Road-related Activities - Various road management activities (construction, reconstruction, decommissioning and maintenance) could affect individuals, populations, or habitat. Effects could be both negative and positive. Negative effects could occur if individuals or populations are directly eliminated from the disturbance site; however, site-specific surveys prior to operations would greatly reduce this potential. Activities would also provide ground disturbance that could allow nearby populations to expand their numbers.

Effects from Recreation Activities – Developed and dispersed recreation activities would not measurably affect RBC population or habitat. No large-scale facility or trail development is planned under any alternative. Although facilities are allowed in many areas, any development would be very small on a Forest-wide scale. Facility and trail maintenance would not affect habitat.

Effects from Watershed Restoration Activities - Soil and water restoration activities tend to occur in localized areas and would be preceded by site-specific surveys prior to project implementation. Short-term effects from disturbance would be similar to those described for Road-related Activities, above. These types of activities are not expected to vary much by alternative.

Effects from Salvage Activities – Timber salvage would occur only after areas have been already damaged or altered by natural disturbances, and would likely not vary much by alternative over the short term. Effects would typically be minimal due to the relatively small scale of salvage operations on this Forest, and any activities would be preceded by site-specific surveys for T&E plants.

Effects from Wildlife Habitat Management Activities - Wildlife opening or savannah establishment could eliminate individuals or populations from the disturbance site; however, site-specific surveys prior to operations would greatly reduce this potential. Potential effects from fire or harvest-related habitat treatments are covered elsewhere in this section. Fisheries habitat restoration activities would likely have no effect on RBC populations or habitat.

Effects from Timber Harvest Activities – Timber harvest would likely have the greatest potential for effects on RBC habitat due to the relatively widespread potential for ground disturbance and habitat manipulation. This potential would vary by alternative and will be therefore addressed in the Direct and Indirect Effects section below.

Small Whorled Pogonia (SWP)

Effects from Mineral Operations - Federal and private owned mineral development may occur within SWP habitat, but development is not expected to be extensive or vary much by alternative (see *Mineral Resources* section). By far the major activity that could affect this species is disturbance related to gas development (well sites, roads, pipelines). On average, each well site is approximately 2 acres, with associated roads and pipelines that create narrow linear openings and ground disturbance, for a total of about 15.5 acres of disturbance. Negative effects could occur if individuals or populations are directly eliminated from the disturbance site; however, site-specific surveys prior to operations would greatly reduce this potential.

Effects from Range Activities – SWP habitat would not be affected by continued range management activities, and range management activity would not vary by alternative since existing pasture areas are not potential habitat for SWP. No new range areas are expected to be created.

Effects from Fire-related Activities – Fire suppression activities are not expected to vary by alternative, nor can it be predicted where these activities would occur. Negative effects could occur if individuals or populations are directly eliminated from the disturbance site. However, wildfire and fire suppression activities are currently at fairly low levels on the Forest, and they are not expected to increase dramatically over the short term.

Prescribed fire is allowed within most areas of the Forest. Site-specific burn plans and a NEPA analysis would be completed at the project level for each burn, and burn plans would be designed to mitigate any potential adverse effects on T&E species. Prescribed fire is not likely to be used as a vegetation management tool in mixed mesophytic forests because fire is not a common disturbance regime there. However, prescribed fire could be used in oak and pine-oak forests because fire is considered a disturbance that needs to be re-introduced in some areas. The one known SWP site is located in an area considered to be Fire Regime I (0-35 year, low intensity). The SWP site is in a mesic micro-site within this landscape. Prescribed fire could be applicable to essentially all of the mature oak and mature pine-oak forests considered habitat for SWP. Based on the single occurrence on the Forest, SWP found in these forest types would likely be found in areas with ephemeral or intermittent water that would likely act as fire breaks. In general, prescribed fires on the Forest create patchy burned conditions. However, the potential exists for prescribed fire to impact individual SWP plants.

Effects from Road-related Activities - Various road management activities (construction, reconstruction, decommissioning and maintenance) could affect individuals, populations, or habitat. Negative effects could occur if individuals or populations are directly eliminated from the disturbance site; however, site-specific surveys prior to operations would greatly reduce this potential.

Effects from Recreation Activities – Developed and dispersed recreation activities would not measurably affect SWP population or habitat. No large-scale facility or trail development is planned under any alternative. Although facilities are allowed in many areas, any development would be very small on a Forest-wide scale. Facility and trail maintenance would not affect habitat.

Effects from Watershed Restoration Activities - Soil and water restoration activities tend to occur in localized areas and would be preceded by site-specific surveys prior to project implementation. Short-term effects from disturbance would be similar to those described for Road-related Activities, above. These types of activities are not expected to vary much by alternative.

Effects from Salvage Activities – Timber salvage would occur only after areas have been already damaged or altered by natural disturbances, and would likely not vary much by alternative over the short term. Effects would typically be minimal due to the relatively small scale of salvage operations on this Forest, and any activities would be preceded by site-specific surveys for T&E plants.

Effects from Wildlife Habitat Management Activities - Wildlife opening or savannah establishment could eliminate individuals or populations from the disturbance site; however, site-specific surveys prior to operations would greatly reduce this potential. Potential effects from fire or harvest-related habitat treatments are covered elsewhere in this section. Fisheries habitat restoration activities would likely have no effect on SWP populations or habitat because they would not occur within potential habitat.

Effects from Timber Harvest Activities – Timber harvest would likely have the greatest potential for effects on SWP habitat due to the relatively widespread potential for ground disturbance and habitat manipulation. This potential would vary by alternative and will be therefore addressed in the Direct and Indirect Effects section of this analysis.

Shale Barren Rock Cress

Potential habitat for SBRC is defined as shale barren areas with surface rock. Potential and known habitat on the Forest is estimated to be less than 100 acres. An analysis of programmatic effects is not suited for such a small acreage. Known sites are protected by either assignment to an 8.0 management prescription or as protected inclusions in other prescriptions. Populations are monitored and management of the habitat is coordinated with the WVDNR Heritage Program staff. Therefore, there would likely be no measurable direct or indirect effects to SBRC as a result of implementing any of the alternatives.

Virginia Spiraea

Virginia spiraea is a riparian shrub found mainly along lower elevation reaches of high energy streams and rivers, this habitat is estimated to be about 18,000 acres across the Forest. Because this habitat is not wide-spread across the Forest and the plant is restricted to riparian areas, an analysis of effects by management prescription or activity is not necessary. Riparian area protection measures identified under Forest-wide shade strips for Alternative 1, and under revised Forest-wide Soil and Water direction for Alternatives 2-4, would be applied site-specifically at the project level, and would greatly reduce the potential for impacts to Virginia spiraea along streams and rivers. As with other T&E species, surveys would be made before management occurs. Generally timber harvest does not occur in the riparian areas of larger streams and rivers. Threats to the species include large scouring floods, competition from natives and non-native plants, and clearings made by recreationists. Therefore, there would likely be no measurable direct or indirect effects to Virginia spiraea as a result of implementing any of the alternatives.

General Effects to T&E Animal Species

Virginia Big-eared Bat

General effects are described below for VBEB foraging habitat, hibernacula, and maternity/ summer colony sites. VBEB typically forage within 6 miles of their hibernacula and summer colony sites. Foraging areas remain constant (exceptions would be new cave or summer colony discoveries) and would not vary by alternative.

Effects from Mineral Operations - There are currently 44 existing gas well sites within Virginia big-eared bat foraging areas. Gas well sites generally add to landscape diversity and provide potential Virginia big-eared bat foraging habitat, although they could degrade habitat if they are constructed in existing herbaceous openings. It is not possible to predict with any accuracy the amount of future gas development under the plan alternatives, although the amount is expected to be within the limits projected by the 1991 Environmental Assessment for oil and gas development (USDA Forest Service 1991). All Forest Plan alternatives provide broad direction on where and how leasing and development of federal gas can occur, but do not make specific decisions about the location, amount, or timing of gas development. The amount of surface modification associated with future gas development is not expected to be extensive under any alternative (see *Mineral Resources* section in Chapter 3 of the EIS). In addition, plan direction includes the following protections:

- Under Alternative 1, seismic exploration and use of explosives would not be allowed within 200 feet of hibernacula, maternity colonies, and bachelor colonies. Under the action alternatives, seismic exploration and use of explosives would not be allowed within 200 feet of these features unless analysis shows that such activities would not adversely affect Virginia big-eared bat populations or habitat.

- Under all alternatives, surface occupancy for federal mineral operations would not be allowed within 200 feet of hibernacula, maternity colonies, or bachelor colonies.

Development of other minerals is rare on the Forest, but could occur in the future. Effects from minerals other than gas developments are difficult to predict because they vary depending on what is being developed, recovery methods, surface disturbance intensity and reclamation.

For these reasons, it is expected that Virginia big-eared bat foraging would not be adversely affected by existing or future federal mineral activities, although quality foraging areas may increase slightly due to creation of new herbaceous openings. Because the total area to be affected by development of federal minerals is expected to be small, effects on foraging habitat are likely to be negligible. Protections for hibernacula, maternity, and bachelor colony sites would make adverse effects to these features unlikely.

Development of privately-owned minerals beneath NFS lands is controlled by the deed. While the MNF would attempt to coordinate with private mineral owners and the USFWS to avoid impacts, the MNF generally has little authority over private mineral operations. Depending on the terms of the mineral severance deed, the MNF may have some discretion over the location of surface occupancy associated with private mineral developments. In such cases the MNF would encourage locations that avoid adverse impacts to Virginia big-eared bat sites. The federal action would be limited to the MNF’s authority, which may not include the effects of the mineral development itself. Therefore, any effects of private mineral development beyond those over which the deed allows MNF discretion are not analyzed as part of this federal action. ESA compliance for those effects would be the responsibility of the private mineral developer.

Effects from Range Activities - There are currently 4,315 Forest Service range allotment acres within available Virginia big-eared bat foraging area. Range allotments provide habitat diversity and contribute to the mosaic of land types within forage areas. Under all alternatives, development of new range allotments is expected to be limited to newly acquired land that is already pasture or hay land. Therefore, bat foraging would not be affected by continued range management activities, as activities would not alter habitat or foraging opportunities.

There are no known hibernacula or summer colony sites within existing range allotments. There may be instances where abandoned buildings located within Forest Service range allotments are used during the summer by Virginia big-eared bats; however, grazing activities within those allotments should not affect Virginia big-eared bat use. Prior to taking actions on buildings within 6 miles of hibernacula or summer colonies, Forest-wide direction for all alternatives requires that the buildings be evaluated to determine whether they are being used by Virginia big-eared bats, and negative effects must be avoided. Therefore, range management activities are not expected to affect roosting or hibernating Virginia big-eared bats.

Effects from Fire-related Activities – The location and extent of wildfire suppression activities are difficult to predict due to the unpredictable nature of wildfire. Fire suppression along edge and within brushy habitats allows for continued succession, which could eventually reduce available edge and habitat diversity. Wildfire suppression in forested areas may deter formation of new edge habitat and openings. These potential negative effects would likely be more than compensated for by the use of prescribed fire, as described below. Currently wildfire and fire suppression activities occur at fairly low levels on the Forest, and they are not expected to increase dramatically over the short term under any alternative.

Prescribed burning is allowed within Virginia big-eared bat foraging areas under all alternatives. Site-specific burn plans would be completed at the project level for each burn, and these plans must consider potential effects on TEP species. It is believed that burn plans could be designed to avoid adverse effects on Virginia big-eared bats. Past prescribed burns have been used to maintain openings and edge habitats that otherwise could revert to forest. Repetitive burning may result in loss of mid and understory species, but may promote herbaceous species. An expanded prescribed fire program would create more open stands with an herbaceous component in the understory, which could improve Virginia big-eared bat foraging areas. The amount of prescribed fire in foraging areas would vary by alternative and is analyzed in more detail under the discussion of direct and indirect effects by alternative.

Under all alternatives, vegetation management, which could include prescribed burning, would only occur within 200 feet of hibernacula or maternity/summer colonies to maintain or enhance bat habitat, or for public safety or research purposes. Prescribed fire within 200 feet of hibernacula and maternity/summer colonies is considered unlikely because of the risk of smoke entering the cave, but no plan alternative specifically prohibits it. If prescribed fire were to be used, a burn plan would be required to ensure protection or maintenance of TEP species and habitat. Naturally occurring wildfire is unpredictable; however, fire suppression would be used to extinguish fires that are close enough to known maternity/summer colonies or hibernacula for smoke to enter the cave. Negligible effects to Virginia big-eared bat hibernacula and maternity/summer colony sites from fire-related activities are expected due to the protections described above.

Effects from Road-related Activities - Current Forest roads provide edge habitat and travel corridors used by many species, including bats. New road construction or reconstruction would likely increase these beneficial effects. Road decommissioning would have the opposite effect as corridors fill in with trees over time, unless decommissioned roads are maintained as linear wildlife openings. It is possible that Virginia big-eared bats could collide with vehicles traveling during the night. However, the majority of night-time vehicular use within Virginia big-eared bat foraging areas would occur on state or county roads rather than Forest roads.

Future road construction and decommissioning levels are difficult to predict for a number of reasons (see *Road Transportation System* section in Chapter 3 of the EIS). Also, under all alternatives it is expected that the overall amount of roads added to the transportation system would only be a very small portion of the 324,000 available foraging acres on the Forest due to such factors as MP road density constraints, anticipated incidental take restrictions for the Indiana bat, site-specific resource concerns, and a 2006 Forest Plan goal to determine the minimum transportation system necessary to achieve access management objectives.

Under all alternatives, new road or trail development is prohibited within 200 feet of Virginia big-eared bat hibernacula and summer colonies. Currently there are no Forest Service system roads or trails within 200 feet of any Virginia big-eared bat maternity/summer colony sites or hibernacula. Unauthorized user-created trails may lead to some caves; however, they are not part of the transportation or trail system and any effects caused by these trails are not considered to be effects caused by implementation of the Forest Plan. Due to the prohibition on road and trail construction within 200 feet of these areas, there would be no effects to Virginia big-eared bat hibernacula or maternity/summer colony sites.

Effects from Recreation Activities – Dispersed recreation opportunities occur within foraging areas; however, these activities would not measurably affect VBEB foraging activity as most human recreation is done during daylight hours. There are several developed recreation areas within VBEB foraging habitat, ranging from day use picnic areas to the Seneca Rocks Discovery Center. Existing facility and trail maintenance would not measurably affect Virginia big-eared bat foraging habitat. No large-scale facility development or new trail development is planned under any alternative. Although facilities are allowed in many areas, any development would be very small on a Forest-wide scale.

Sport caving (spelunking) is fairly popular on the MNF and will likely continue in the future. There are an estimated 260 inventoried caves on the Monongahela National Forest; and 14 are heavily used, mainly because of their easy accessibility. All VBEB hibernacula located on Forest Service lands are closed to public entry from September 1 to May 15. Caves used during the maternity season are closed to public entry from April 1 to September 15 (2006 Forest Plan Standards TE16, TE17). Caving activities and restrictions would not vary by alternative. For these reasons, no effects are expected to Virginia big-eared bat hibernacula or maternity sites under any alternative.

Effects from Watershed Restoration Activities – Soil, water, riparian, and aquatic restoration within foraging areas and within 200 feet of hibernacula and maternity/summer colony sites are not explicitly limited under any Forest Plan alternative. However, if such activities involve vegetation management, they may occur within 200 feet of hibernacula and maternity/summer colony sites only if conducted for maintenance or improvement of bat habitat, public safety, or research. Restoration activities tend to occur in localized areas on a very small scale, and would therefore not measurably affect available Virginia big-eared bat foraging habitat, hibernacula, maternity or summer colony sites across the Forest.

Effects from Salvage Activities – Timber salvage would occur only after areas have been already damaged or altered by natural disturbances. As VBEBs are not known to use trees for roost or maternity sites, tree removal would have negligible negative effects on habitat or individuals, and could have a small positive effect by opening up potential foraging areas. Activities would not occur within 200 feet of hibernacula or maternity sites unless the activity is beneficial to VBEB or other threatened or endangered species. These activities would not vary by alternative.

Effects from Wildlife Habitat Management - Wildlife habitat management may add to diversity within VBEB foraging habitat depending on the activity planned. Wildlife opening creation and maintenance would help ensure edge habitat and herbaceous foraging habitat. Other localized activities would likely have little or no effect unless they were specifically designed to benefit VBEB foraging habitat. Fisheries habitat restoration activities would be limited to stream channel and bank enhancements and would have no affect on VBEB foraging. Activities would not occur within 200 feet of hibernacula or maternity/summer colony sites unless the activity is beneficial to VBEB or other threatened or endangered species. These activities would not vary by alternative.

Effects from Timber Harvest Activities – As noted above, tree removal and associated road activities are not major concerns for this species. Virginia big-eared bats use caves year-round, although standing timber may be used for night roosting. Because the bats return to caves during the day, or occasionally day roost under bridges or in man-made structures, there would be little or no direct effect on Virginia big-eared bat individuals from timber harvesting activities. Under all alternatives, activities would not occur within 200 feet of hibernacula or maternity/summer colony sites unless they are conducted for maintenance or improvement of bat habitat, public safety, or research. Therefore, timber harvest activities are not expected to have any negative effects on hibernacula and maternity/summer colonies under any alternative.

Timber harvest could affect Virginia big-eared bat foraging habitat due to its ability to create openings and edge, particularly through even-aged regeneration harvest. Because Virginia big-eared bats forage in a wide variety of open and forested habitats, even-aged regeneration harvest over a modest portion of the landscape is not believed to have measurable negative effects on habitat. However, timber harvest has not been shown to be beneficial. Under all alternatives, less than 20 percent of Virginia big-eared bat foraging habitat would be considered suitable timberland, so even-aged regeneration harvest would be likely to affect only a small portion of foraging habitat.

<u>Indiana Bat</u>

Effects from Mineral Operations – Natural gas leasing is by far the most common form of mineral development on the Forest. Although gas exploration and development are generally allowed within Indiana bat habitat, there are a number of restrictions that would limit effects from these activities:

- Alternative 1 would prohibit seismic exploration and explosive use within key areas and within 200 feet of hibernacula. The action alternatives would prohibit seismic exploration and explosive use in these areas unless analysis shows that these activities would not adversely affect bat populations or habitat.
- All alternatives would prohibit surface occupancy for federal mineral operations within key areas and within 200 feet of hibernacula.
- Alternative 1 would prohibit surface occupancy for federal mineral operations within 2 miles of a maternity site. The action alternatives would stipulate that surface occupancy within 2.5 miles of a maternity site must be compatible with Indiana bat population maintenance or recovery.

The total amount of surface modification associated with future gas development is not expected to be extensive under any alternative (see description of mineral activities above, also the *Mineral Resources* section in Chapter 3 of the EIS).

Other mineral development is rare on the Forest, but could occur in the future. Effects from minerals other than gas developments are difficult to predict because they vary depending on what is being developed, recovery methods, surface disturbance intensity, and reclamation.

For the reasons listed above, it is expected that mineral operations would have minor effects on Indiana bats and their habitats under all alternatives. However, mineral development usually does involve a certain amount of land clearing and road development, which could remove potential roost trees or harm roosting bats. Therefore, not all risk of adverse effects due to mineral activities can be eliminated.

Development of privately-owned minerals beneath NFS lands is controlled by the deed. While the MNF would attempt to coordinate with private mineral owners and the USFWS to avoid or reduce impacts, the MNF generally has little authority over private mineral operations. Depending on the terms of the mineral severance deed, the MNF may have some discretion over the location of surface occupancy associated with private mineral developments. In such cases the MNF would encourage locations that avoid adverse impacts to Indiana bat sites. The federal action would be limited to the MNF's authority, which may not include the effects of the mineral development itself. Therefore, any effects of private mineral development beyond those over which the deed allows MNF discretion are not analyzed as part of this federal action. ESA compliance for those effects would be the responsibility of the private mineral developer.

Effects from Range Activities – There are currently 1,777 acres of Forest range allotments within Indiana bat primary range, and there are no known hibernacula, key areas, or maternity sites within these allotments. Range allotment locations and management activities allowed within allotments would not vary by alternative and are not expected to increase in the foreseeable future. Continued range management would have no effect on Indiana bat habitat components or individuals because grazing activities and facilities would not alter Indiana bat habitat or disturb populations.

Effects from Fire-related Activities – Both wildfire and prescribed fire have the potential to destroy or create snags for Indiana bat roost trees or maternity sites. Under the action alternatives, protective measures for NFS lands within 2.5 miles of potential or confirmed maternity sites would be determined at a site-specific level in cooperation with USFWS and WVDNR. Alternative 1 would apply protective measures within a 2-mile radius. Under all alternatives, prescribed fire plans would include provisions to protect known roost trees, including both maternity and non-maternity roosts. The one confirmed Indiana bat maternity site within the proclamation boundary (found in 2004) is located in an area that experienced a wildfire in 2003, resulting in a generous number of snags with sloughing bark. This maternity site is on private land within the proclamation boundary and would not be subject to MNF management, although the 2.5-mile radius surrounding the site includes NFS lands that would be subject to conservation measures, with activities to be considered on a case-by-case basis.

Prescribed or controlled fire could also be used to help thin out and maintain favorable foraging and roosting conditions within Indiana bat habitat. Opportunities for prescribed fire within primary range would vary by alternative and are covered in the discussion of direct and indirect effects by alternative. Uncontrolled wildfire, on the other hand, would have more potential for stand-replacing events over time as stands age and fuels increase. Stand-replacing fire would add habitat diversity, but, depending on the size of the event, could be detrimental to foraging conditions by opening up too much forest canopy.

Harm or mortality of individual bats could result from smoke entering occupied hibernacula, roost trees, or maternity sites. Prescribed fire and associated fuel reduction activities may also cause harm or mortality through flames, heat, and loss of roost trees. However, prescribed fire is subject to a burn plan under all alternatives. The burn plan likely would require that burning be conducted under conditions that optimize smoke dispersal, and likely would contain provisions to protect hibernacula, known roost trees, and known maternity sites. Therefore, negative effects of prescribed fire on individuals are expected to be infrequent. However, because some roost trees and maternity sites may not be detected, all risk associated with prescribed fire cannot be eliminated.

All alternatives would continue the current policy of suppressing wildfires when they are detected. Wildfire suppression activities such as fire line construction could destroy potential roost trees. Every effort would be made to avoid known roost trees, within the constraints of protecting human life and property. Typically, wildfire on the Forest does not exceed 100 acres per year, and at this rate the potential effects to Indiana bats and their habitats due to fire suppression activities would be minor.

Effects from Road-related Activities – Current Forest roads provide edge habitat and travel corridors used by many species, including bats. Road corridors also provide solar exposure to trees and snags along the road, potentially increasing their suitability as roost trees for Indiana bats. New road construction or reconstruction would likely increase these beneficial effects. Road decommissioning would have the opposite effect as corridors fill in with trees over time, except where decommissioned roads are maintained as linear wildlife openings.

The major negative effects of road construction are the loss of potential roost trees and potential harm or mortality of roosting bats during clearing of the road alignment. The possibility also exists that Indiana bats could collide with vehicles traveling during the night. However, the majority of night-time vehicular use within Indiana bat foraging areas would occur on state or county roads rather than Forest roads, so collisions are considered extremely unlikely.

Future road construction and decommissioning levels are difficult to predict for a number of reasons (see *Road Transportation System* section in Chapter 3 of the EIS). The overall amount of roads added to the transportation system is expected to be a very small portion of the 228,000 acres of primary range on the Forest due to such factors as MP road density constraints, site-specific resource concerns, and a 2006 Forest Plan goal to determine the minimum transportation system necessary to achieve access management objectives. Also, Forest-wide standards in the 2006 Forest Plan prohibit new road construction within 200 feet of Indiana bat hibernacula and require that new roads avoid key areas and maternity sites. For all of these reasons, road-related activities are expected to have small adverse effects on Indiana bats and their habitats. However, the potential for loss of roost trees and harm to roosting bats during road construction and reconstruction cannot be discounted.

Effects from Recreation Activities – Developed recreation facilities include campgrounds, picnic areas, swimming beaches, visitor centers and historic sites. No large-scale facility development is planned for the foreseeable future, but the 2006 Forest Plan does allow construction of new facilities. Although new facilities are allowed in primary range, any development likely would cover a negligible portion of the total Forest-wide foraging and swarming habitat. Forest-wide direction for all alternatives prohibits the construction of new recreational facilities within key areas and within 200 feet of hibernacula, so developed recreation would not impact these habitat features. Facility construction, renovation, and maintenance is likely to be quite limited for the foreseeable future, with habitat alteration consisting of removing small numbers of trees in localized areas such as trailheads, campgrounds, picnic areas, etc. Therefore, tree cutting associated with recreation facilities is considered extremely unlikely to cause loss of roost trees or harm to individuals.

Dispersed recreation occurs outside of developed sites and includes activities such as boating, driving for pleasure, fishing, hunting, caving, hiking and biking. Dispersed recreation activities that use existing roads, trails, and other access features do not change habitat structure, so they should have no effect on primary range or maternity sites. Development and reconstruction of trails is expected to be very limited for the foreseeable future under all alternatives, so loss of roost trees and harm to individuals due to tree cutting for trail work is considered extremely unlikely. Under all alternatives, new trail development is prohibited in key areas and within 200 feet of hibernacula, and thus would not affect these habitat components. Therefore, these dispersed recreation activities are unlikely to affect Indiana bats.

Sport caving (spelunking) is fairly popular on the MNF and will likely continue in the future. Forest Plan direction under all alternatives requires that major hibernacula be closed to public entry from September 1 to May 15. Direction for the action alternatives clarifies that minor hibernacula can remain open to public use if the MNF, USFWS, and WVDNR agree that such use would be extremely unlikely to cause harm or mortality. Based on this direction, it is unlikely that recreational cave use would adversely affect hibernating Indiana bats.

Effects from Watershed Restoration Activities – Watershed restoration activities would not likely vary much by alternative and are not expected to adversely affect Indiana bats or their habitats because activities would be localized and designed to restore riparian areas or road corridors to productivity over the short and long term. Activities do not typically remove the types of trees that bats could use for roosting or maternity sites. However, if a maternity site is discovered within in a watershed restoration area, protective measures would be determined at a site-specific level in cooperation with USFWS and WVDNR.

Effects from Wildlife and Fish Habitat Restoration – Fish habitat restoration likely would not affect Indiana bats or their habitats because restoration activities would be localized within streams and stream banks and would not impair the ability of streams to serve as water sources and foraging corridors. Creation of large woody debris from standing trees could remove some potential roost trees, but this activity likely would involve only scattered individual trees in small, localized areas. Therefore, harm to a roosting bat would be extremely unlikely to occur.

Wildlife habitat management to enhance Indiana bat primary range could differ across alternatives and is covered in the discussion of direct and indirect effects by alternative. Maintained wildlife openings in primary range generally are not considered habitat restoration for the Indiana bat, although in otherwise closed canopy forested areas, they could contribute to habitat diversity. Proposed wildlife openings in primary range would need to be evaluated on a case-by-case basis to ensure that they benefit the Indiana bat.

Wildlife opening creation outside of primary range would continue Forest-wide. Many openings are small (< 1 acre) and are created in conjunction with timber harvest activities, i.e., seeded log landings and temporary roads. While creation of such openings may involve minor expansion of the landings, tree removal is very limited and is extremely unlikely to cause any harm to roost trees or Indiana bats beyond that due to the original timber harvest. Larger openings and savannas are sometimes created in areas other than log landings. Tree removal associated with such openings may have a risk of harm to roost trees and individuals. For a discussion of differences in the amount of openings among the alternatives, see the Terrestrial Ecosystem Diversity section in this chapter.

Other small-scale wildlife management activities, such as nest boxes, water holes, reptile/amphibian coverboards, etc. would involve little or no habitat disturbance and are extremely unlikely to affect the Indiana bat.

Effects from Salvage Activities - Timber salvage would occur only after areas have already been damaged or altered by natural disturbances, insect infestations, or disease. Salvage in Indiana bat primary range, which would include hibernacula and key areas on NFS lands, would be unlikely to occur under any alternative due to a requirement to retain all snags over 5 inches in diameter within harvest units in primary range. The requirement that vegetation management in primary range must be primarily for enhancement or maintenance of Indiana bat habitat also would make salvage unlikely in primary range under any alternative. Salvage could occur elsewhere across the Forest and potentially affect undiscovered maternity sites or roosting individuals. If allowed by the timing of the salvage activities, surveys would be conducted prior to project implementation to try to identify any unknown maternity sites and roost trees. If a site is discovered, protective measures would be determined at a site-specific level in cooperation with USFWS and WVDNR. Any roost trees discovered, including non-maternity roost trees, would be protected until they no longer serve as roost trees. However, salvage activities often must be conducted quickly following tree mortality, so adequate surveys may not be possible in many cases. Also, mist net surveys cannot guarantee that all roost trees will be located. Therefore, the risk of harm or mortality of roosting bats cannot be eliminated.

Effects from Timber Harvest Activities – Within primary range, which also includes all hibernacula and key areas, management of vegetation 5 inches dbh or greater may only be implemented to improve or maintain Indiana bat or other TEP or sensitive species habitat, address public or worker safety concerns, or achieve research objectives. See the discussion of beneficial effects of habitat management in the discussion of direct and indirect effects by alternative. Effects of timber harvest outside of primary range would vary by alternative and are covered below in the discussion of direct and indirect effects by alternative.

Timber stand improvement and site preparation may involve control of understory vegetation and small trees up to 5 inches DBH. By enhancing semi-open stand structure, timber stand improvement could have beneficial effects on Indiana bat foraging and roosting habitat. Trees less than 5 inches DBH generally do not provide roosting habitat, so negative effects from timber stand improvement are considered extremely unlikely.

<u>West Virginia Northern Flying Squirrel</u>

Effects from Mineral Operations - Natural gas leasing is by far the most common mineral development on the Forest. Development of federal gas would generally be allowed in suitable WVNFS habitat as long as it is within the limits projected in the 1991 Environmental Assessment for oil and gas leasing and development (USDA Forest Service 1991), and as long as protection measures for WVNFS are developed through consultation with USFWS.

Including both production wells and wells associated with gas storage, there are currently 71 existing gas well sites on NFS lands. Only 12 of these occur within suitable West Virginia northern flying squirrel habitat. On average, each well site is about 2 acres with grassy ground cover, similar to hayfields. Access roads and associated pipelines create narrow linear openings and may add up to an additional 14 acres of grassy or graveled area per well site. Effects from future gas development likely would be similar under all alternatives. However, due to the irregular shape of most areas of suitable habitat, for many potential wells it is possible that not all of the impact associated with the well and its supporting facilities would occur within suitable habitat. The MNF would work with lessees to locate impacts outside of suitable habitat to the extent possible. For the foreseeable future, the maximum potential disturbance associated with gas development on all land ownerships within the proclamation boundary is estimated to be 740 acres per decade (See *Mineral Resources* section in this Chapter). It is not possible to predict accurately how much of this development would occur within WVNRS suitable habitat on NFS land. However, Forest Plan direction to apply site-specific protection measures is expected to make negative effects extremely unlikely.

Development of other federal minerals currently is rare on the Forest, but could occur in the future under the 2006 Forest Plan. Other than natural gas, coal and limestone are the only minerals known to be present in commercial quantities. Demand for these minerals currently is being met through off-Forest sources, and the scattered nature of federal coal deposits makes them unlikely to be developed in a cost-effective fashion. Therefore, development of minerals other than natural gas is not likely to be extensive (see *Mineral Resources* section in this chapter). Effects from minerals other than gas developments are difficult to predict because they vary depending on what is being developed, recovery methods, surface disturbance intensity, and reclamation. The 2006 Forest Plan does not specifically address these other operations as they relate to West Virginia northern flying squirrel habitat, so consultation with USFWS would occur on a project-by-project basis. However, given that extensive development is unlikely, adverse effects are considered extremely unlikely.

Development of privately-owned minerals beneath NFS lands is controlled by the deed. While the MNF would attempt to coordinate with private mineral owners and the USFWS to avoid impacts, the MNF generally has little authority over private mineral operations. Depending on the terms of the mineral severance deed, the MNF may have some discretion over the location of surface occupancy associated with private mineral developments. In such cases the MNF would encourage locations that avoid adverse impacts to WVNFS and suitable habitat. The federal action would be limited to the MNF's authority, which may not include the effects of the mineral development itself. Therefore, any effects of private mineral development beyond those over which the deed allows MNF discretion are not analyzed as part of this federal action. ESA compliance for those effects would be the responsibility of the private mineral developer.

Effects from Range Activities - Because some grazing allotments have inclusions of forested land dispersed within them, there are 428 allotment acres currently typed as suitable WVNFS habitat. There is also a single known WVNFS capture record located within a grazing allotment. Under all alternatives, Forest Plan direction addressing vegetation management in suitable habitat would prohibit vegetation manipulation associated with range management unless it could be shown to have no adverse effects. Continuation of current livestock grazing would be extremely unlikely to affect WVNFS or suitable habitat, as grazing activities would not alter WVNFS habitat or use. Development of new range allotments is expected to be limited to newly acquired land that is already pasture or hay land. Range allotment locations and management activities allowed within allotments are not expected to change appreciably in the foreseeable future. Range management would be extremely unlikely to cause negative impacts to West Virginia northern flying squirrel habitat or individuals because grazing activities and facilities would not detrimentally alter existing habitat or disturb populations.

Effects from Fire-related Activities - Typically, wildfire starts on the Forest do not exceed 100 acres per year, and starts would not generally spread within suitable WVNFS habitat as these areas are high-elevation, moist stands. When wildfire occurs, suppression activities would occur to the extent possible, which could limit fire damage in suitable habitat. Because large wildfires are not likely to occur within suitable habitat, negative effects from wildfire suppression activities would be extremely unlikely.

Prescribed fire activity would not normally occur in suitable squirrel habitat unless the proposed burns meet research or habitat enhancement criteria in the 2006 Forest Plan direction for suitable habitat. In the unlikely event that prescribed fire is used in suitable habitat, a prescribed burn plan would be developed prior to burning, and consultation with USFWS would also occur to determine ways to avoid adverse effects. Therefore, adverse effects due to prescribed fire are extremely unlikely.

Effects from Road related Activities – Due to restrictions on vegetation management in WVNFS suitable habitat, little road construction and reconstruction is likely to occur in suitable habitat. Limited exceptions to this may be made for research projects, projects related to mineral development, or access to private lands. Such limited road reconstruction and maintenance within suitable habitat has little potential to affect WVNFS adversely.

Effects from Recreation Activities - Developed recreation facilities include campgrounds, picnic areas, swimming beaches, visitor centers, and historic sites. Several developed facilities may exist within suitable WVNFS habitat; however, new developed facilities are prohibited in suitable habitat. Smaller facilities such as trails, trailheads, picnic sites, and ¼-acre vistas are allowed in suitable habitat, but only if project-level analysis determines that an adverse effect is unlikely. Typical maintenance activities do not involve large-scale habitat alteration and would have little or no potential for adverse effects.

Dispersed recreation activities occur outside of developed sites and include activities such as boating, fishing, hunting, hiking, and biking. Because WVNFS are nocturnal, dispersed recreation disturbances from hiking, backpacking, hunting, fishing, camping, mountain biking, etc. would likely not affect WVNFS. These activities also would not alter the habitat enough to cause measurable effects.

Effects from Watershed Restoration – Watershed restoration activities typically involve stabilization of stream banks, exposed soils, and decommissioned road beds, as well as the addition of habitat structure to stream channels. Such activities have little or no potential to affect West Virginia northern flying squirrels or their suitable habitat. To the extent that such activities involve vegetation management, Forest Plan direction under all alternatives would not allow them within suitable habitat unless project-level analysis determined that the activities would not be likely to cause an adverse effect.

Effects from Wildlife and Fish Habitat Restoration - New wildlife habitat improvements would not occur within WVNFS suitable habitat unless they are part of approved research on suitable habitat, they improve suitable habitat based on the results of earlier research, or project-level analysis determines that they would not be likely to adversely affect the WVNFS. Therefore, there is little or no potential for adverse effects. Such projects would have the potential for beneficial effects through the enhancement of habitat.

Spruce restoration areas that are outside of suitable habitat have the potential for beneficial effects over the long term. Because these areas are not considered suitable habitat, there is little or no potential for adverse effects due to active spruce restoration, and long-term beneficial effects would be expected due to possible increases in habitat. The Terrestrial Ecosystem

Diversity and Management Indicator Species and Other Species of Interest sections in this chapter discuss spruce restoration potential by alternative.

Effects from Salvage Activities - Salvage harvesting is not allowed in suitable WVNFS habitat unless it meets the conditions set by Forest Plan direction (research on suitable habitat, improvement of suitable habitat, or is not likely to adversely affect the squirrel). If a natural disturbance damages suitable habitat so extensively that it is no longer considered suitable, salvage harvesting could occur. However, prior to project approval, the suitable habitat map would need to be changed in coordination with USFWS and WVDNR. Therefore, no adverse effects are expected.

Effects from Timber Harvest Activities - Vegetation/timber management generally is not allowed in WVNFS suitable habitat. Exceptions to this prohibition would only occur on a case-by-case basis if they meet the conditions set by Forest Plan direction (research on suitable habitat, improvement of suitable habitat, or not likely to adversely affect the squirrel). Non-suitable habitat is presumed to be unoccupied by WVNFS (USFWS 2001), so adverse effects due to timber management outside of suitable habitat are unlikely. Therefore, timber management is not expected to have adverse effects on WVNFS.

Cheat Mountain Salamander

The 2006 Forest Plan provides essentially complete protection for Cheat Mountain salamander occurrences on NFS land. Forest-wide direction requires that, prior to any ground- or vegetation-disturbing activity, known and potential habitat be surveyed and the extent of occupied habitat be delineated. The direction further requires that ground- and vegetation-disturbing activities be avoided in occupied habitat and a 300-foot buffer, unless analysis shows there would be no adverse effect on populations or habitat. Therefore, most management activities are not expected to adversely affect the Cheat Mountain salamander, and a discussion of effects for each activity is not presented here.

Bald Eagle

All MNF management activities would have little or no potential to affect the bald eagle under any alternative. Both known nest sites are in the Spruce Knob-Seneca Rocks National Recreation Area, and one site is in a remote backcountry portion of the NRA. Little or no active management is expected near these sites, and public motorized access would not be allowed in the vicinity of the backcountry site. Dispersed recreation would be the only potential source of impacts, and current levels of use have not caused problems. Should increased use become a concern, 2006 Forest Plan direction provides for closure orders to control disturbance.

Under the action alternatives, potential foraging habitat would be protected from most negative impacts of management activities by revised Forest-wide direction for soil and water. Under the No Action alternative, similar direction would be applied through project-specific mitigation measures. This direction places buffers of 100 feet on perennial and large intermittent streams, 50 feet on small intermittent streams, and 25 feet on ephemeral streams. Within these buffers, all programmed timber harvest and all but essential soil disturbance (e.g., road crossings) is prohibited. This protection is expected to reduce management-related impacts to water quality to a negligible level from the standpoint of eagle foraging habitat. Continued maturation of trees in these buffers would likely improve nest site availability over the long term, and continued recovery of aquatic communities from historic impacts would likely improve foraging habitat. Also on a Forest-wide basis, 2006 Forest Plan direction protects all bald eagle nests, whether currently known or discovered in the future, with 1,500-foot buffers. Within these buffers, management strategies that are compatible with eagle nesting would be determined on a case-by-case basis. For these reasons, the potential for negative effects would be negligible, while improvements in nesting and foraging habitat would be likely.

Direct and Indirect Effects to T&E Plant Species by Alternative

Running Buffalo Clover (RBC)

Potential habitat for RBC was estimated as mixed mesophytic hardwood forests in either early or old age classes. RBC is most often found on soils derived from limestone in areas with canopy gaps, and not all mixed mesophytic hardwoods forests fit this more detailed description. Table TE-5 displays the approximate acres of potential habitat by management prescription at the start of the planning period for all alternatives. Since potential habitat is based on successional stages, over time some areas will move into or out of potential habitat due to either management actions or no action. Effects due to changes over time longer than the 5 to 10 years considered here are discussed under the Cumulative Effects subsection.

Table TE-5. Acres of Potential RBC Habitat by MP by Alternative

Management Prescriptions	Alt 1	Alt 2	Alt 2M	Alt 3	Alt 4
MP 5.0, 5.1, 6.2 – Little or no vegetation management	2,600	3,000	3,000	8,000	2,700
MP 4.1, 6.3, 7.0, 8.0 – Low levels of vegetation management	9,700	8,600	8,600	6,900	8,800
MP 2.0, 3.0, 4.0, 6.1 – Active vegetation management	19,900	22,800	22,800	19,400	22,900

Management prescriptions 5.0, 5.1, and 6.2 are grouped together as they represent the areas of lowest potential for active vegetation management. Running buffalo clover is an interesting species to manage. While it is a federally endangered plant, it does need some level of disturbance to perpetuate. Potential habitat in these areas will continue to be suitable for RBC, however shading and lack of mechanical disturbance may limit spread. Known populations will continue to be monitored, and actions proposed as needed. Because active management is not likely in these areas, potential habitat is not likely to be surveyed, so new populations may not be found.

Management prescriptions where active vegetation management is most likely are grouped together for estimate of effects. These MPs include 2.0, 4.0 (Alternative 1 only), 3.0, and 6.1. Most of the potential habitat for RBC is found in these MPs. Surveys for threatened, endangered, and sensitive species would be made in areas proposed for active management. Any populations or individuals found would be protected. Potential direct and indirect effects to RBC in these areas include loss of individuals and populations though road construction, timber harvest and associated developments (skid roads and landings for example). Most known populations of RBC on the Forest are associated with old, seldom used roads. If an older road in potential habitat is used for access, and RBC not surveyed for, individuals could be lost. RBC is somewhat resilient to disturbance in that pieces of plants will re-colonize a road after use, however, if use includes full reconstruction (addition of gravel, continued maintenance), potential habitat and individuals may be lost. Again, surveys for the plant before action would reduce the likelihood of these effects.

Management prescriptions 4.1, 6.3, 7.0, and 8.0 may have low to moderate amounts of vegetation management. MP 4.1 includes areas where active management is expected (mixed hardwoods) and areas where it is generally not expected (suitable habitat for WVNFS). MP 6.3 is primary range for Indiana bats (Alternative 1 only) where some management may be desired. MP 7.0 (Alternative 1 only) includes developed recreation areas, which would not receive much vegetation management but may have vegetation disturbed by recreation development and concentrated use. In Alternative 1, MP 8.0 includes habitat suitable for the West Virginia northern flying squirrel.

MP 8.1 is the NRA, some of which may receive vegetation management, and some of which (SPNM areas) would not. MP 8.2 includes areas designated as National Natural Landmarks. MP 8.3 includes designated Scenic Areas. MP 8.4 includes Ecological Areas, such as Botanical Areas, designated across the Forest. Active management is not likely in MP 8.2, 8.3, or 8.4 areas. MP 8.5 is the Fernow Experimental Forest, which includes known RBC populations. Current research on the Fernow includes a study on the disturbance needs and tolerances of RBC. When actions are proposed on the Fernow, surveys are made for threatened, endangered, and sensitive species. As in other areas of the Forest with active management, known sites would be avoided so that direct effects to RBC would be reduced to minimal if any. MP 8.6 are Grouse Management Areas, which may be periodically managed to maintain early successional conditions.

Because RBC requires some level of disturbance for maintenance of a population, individual plants may be negatively affected as habitat is managed for the population as a whole. The Biological Opinion for the 2006 Forest Plan outlines conservation measures to be used to managed RBC individuals and their habitat. These conservation measures have been incorporated in the 2006 Forest Plan as goals, standards, and guidelines. Forest-wide direction has been added (TE68 through TE83) to address the management needed to conserve RBC.

Alternative 1 - This alternative has about 19,900 acres in active vegetation management MPs with potential RBC habitat. These acres represent about 58 percent of the potential habitat on the Forest. Although 6.3 is considered a suited timber MP for this alternative, relatively little active vegetation management is anticipated due to Indiana bat habitat concerns.

Alternative 2 - Alternative 2 has an estimated 22,800 acres in active vegetation management MPs with potential RBC habitat. These acres represent about 66 percent of the potential habitat on the Forest.

Alternative 2 Modified - Alternative 2 modified has an estimated 22,800 acres in active vegetation management MPs with potential RBC habitat. These acres represent about 66 percent of the potential habitat on the Forest.

Alternative 3 - Alternative 3 has the fewest acres (19,400) in active vegetation management MPs with potential RBC habitat. These acres represent about 56 percent of the potential habitat on the Forest. This alternative also has the most acres (8,000) in MPs with little or no vegetation management potential that is also potential RBC habitat. Under Alternative 3 there is slightly lower risk of impacting RBC potential habitat by active vegetation management. However, knowing that RBC needs some level of mild disturbance to perpetuate and spread, continued monitoring of known populations would be needed.

Alternative 4 - Alternative 4 has the most acres (22,900) in active vegetation management MPs with potential RBC habitat. These acres represent about 67 percent of the potential habitat on the Forest. The acres of potential habitat in areas where active management is likely to occur is about the same as in Alternative 2.

Summary - Timber harvest activities, road construction and reconstruction, and road decommissioning (when it requires earth-moving activities) all have potential to affect RBC. Alternatives 4, 2, and 2 Modified have the greatest chance of impacting RBC and its habitat directly through disturbance. However, considering RBC needs a low level of disturbance to compete with other species, the effects of active management may be positive as well. Since RBC has been found to be tied to either limestone geology or very rich soils, the acres based on mixed mesophytic forests on any geology or soil type as presented in Table TE-4 likely overestimate potential impacts.

Small Whorled Pogonia

Potential habitat for SWP is defined as old and mature mixed mesophytic hardwood forests, old and mature oak, and old and mature pine-oak forests. Table TE-6 shows the acres of this potential habitat for all alternatives at the start of the planning period. Small whorled pogonia has only been found in one location on the Forest. Because of the rarity and difficulty in predicting where we may find SWP again, the potential habitat will not be broken out by management prescription or alternative. Since potential habitat is based on successional stages, over time some areas will move into or out of potential habitat due to management action or no action. Effects due to changes over time, longer than the 5 to 10 years considered here, are discussed under cumulative impacts.

Table TE-6. Acres of Potential SWP Habitat for All alternatives and All MPs

Community Type	Current Acres
Mixed mesophytic hardwoods(old and mature)	329,100
Oak (old and mature)	229,600
Pine-oak (old and mature)	44,500
Total	603,200

Mixed mesophytic forests cover a large portion of the Forest, essentially forming the matrix in which other habitat types occur. Because there is so much area considered potential habitat and this species is so rare, it could be interpreted that the potential habitat description does not accurately represent suitable habitat for this species. As stated before, survey efforts are generally focused on areas where active forest management is to occur; this lack of knowledge may also represent inadequate surveys efforts. SWP may be present in areas not usually proposed for active forest management.

Under all alternatives, the majority of the area considered potential habitat is again found in areas with MPs allowing active forest management. In these areas, direct and indirect effects to SWP would be avoided through surveys made before action is taken. Habitat destruction is the primary threat to this species. Potential habitat in MP 5.0, 5.1, 6.2, and most 8.0 areas is generally protected by the fact that little active management occurs in these areas.

Because this species is so rare and is known to remain dormant in some years, it could be missed in surveys of areas proposed for active management. The largest potential for this to occur is in MP 3.0 or 6.1 areas. If the plant is missed in surveys, direct effects from ground-disturbing activities could include destruction of habitat or loss of individuals. This potential is slightly lower in Alternative 3 than in Alternatives 1, 2, 2 Modified, or 4.

Prescribed fire could be used to manage vegetation on about 162,500 acres of current old and mature oak forests in Fire Regimes I or III, and on about 38,000 acres in old and mature pine-oak forests in Fire Regimes 1 or III. Without considering the management prescription, prescribed fire could be used on about 27 percent of the potential suitable habitat.

Shale Barren Rockcress

There would likely be no measurable direct or indirect effects to SBRC as a result of implementing any of the alternatives. See *General Effects to T&E Plant Species and Habitat* section for this species, above.

Virginia Spiraea

There would likely be no measurable direct or indirect effects to Virginia spiraea as a result of implementing any of the alternatives. See *General Effects to T&E Plant Species and Habitat* section for this species, above.

Direct and Indirect Effects to T&E Animal Species by Alternative

Virginia Big-eared Bat

Effects From Prescribed Fire – Prescribed fire within VBEB foraging circles could have beneficial effects on foraging habitat by encouraging an herbaceous understory. Estimates of potential improvement to Virginia big-eared bat habitat through prescribed fire are based on Forest-wide goals and objectives. Forest-wide prescribed fire objectives focus on Fire Regime

Condition Class (FRCC) I, 3 and FRCC III, 2. These condition classes represent fire-adapted communities that are at risk of losing ecosystem components because of fire exclusion. Objectives also focus on MPs 3.0, 6.1, 6.3, and 8.1, where the management emphasis is compatible with prescribed fire. Objectives for prescribed fire differ among alternatives, with Alternatives 1 and 3 maintaining the current Forest-wide annual limit of 300 acres. Alternatives 2 and 2M have higher objectives that attempt to balance the need for prescribed fire with the Forest's expected ability to accomplish burning to meet that need. Alternative 4 has the highest objective for prescribed fire, which is based primarily on the need as determined by the FRCC classifications. See the Vegetation Management section of this chapter for a more detailed discussion of projected prescribed fire amounts by alternative.

Table TE-7 displays projected amounts of prescribed fire within VBEB foraging habitat for the first decade. These projections assume that prescribed fire would be applied in high priority areas within foraging habitat with the same priority level as similar areas outside of foraging habitat. Because of goals and objectives to enhance habitat for endangered species, areas within foraging habitat could have an even higher priority than other FRCC I, 3 and III, 2 areas, which could result in a larger amount of habitat treated. Conversely, budget and staffing limitations could result in smaller amounts of habitat treated.

Table TE-7. Projected Acres of Prescribed Fire in Virginia Big-Eared Bat Foraging Habitat During the First Decade of the Planning Horizon

Indicator	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Total VBEB Foraging Circle Acres on NFS Land	324,000	324,000	324,000	324,000	324,000
FRCC I, 3 and FRCC III, 2 Acres in MPs 3.0, 6.1, 6.3, 8.1, in VBEB Circles	62,000	69,000	67,000	63,000	69,000
Maximum Projected Acres of Prescribed Fire Treatment in VBEB Circles During the First Decade	1,000	10,000	10,000	1,500	24,000

Alternatives 1 and 3 would have little potential to improve VBEB foraging habitat using prescribed fire, whereas Alternative 4 would increase prescribed fire in VBEB habitat to more than 20 times the currently allowed level. Alternatives 2 and 2M would increase prescribed fire in VBEB habitat substantially beyond current levels, but would still be far below the levels of Alternative 4. Although specific objectives for prescribed fire have not been formulated beyond the first decade of the planning horizon, similar amounts of prescribed fire are expected in subsequent decades.

Indiana Bat

Effects From Prescribed Fire – Within Indiana bat primary range, prescribed fire could be used to create and maintain semi-open stand structure that is favorable for roosting and foraging. Estimates of potential improvement to Indiana bat habitat within 5 miles of hibernacula through prescribed fire are based on Forest-wide goals and objectives in the 2006 Forest Plan. Objectives focus on Fire Regime Condition Class (FRCC) I, 3 and FRCC III, 2. Objectives also focus on MPs 3.0, 6.1, 6.3, and 8.1, where the management emphasis is compatible with prescribed fire.

Table TE-8. Projected Acres of Prescribed Fire in Indiana Bat Primary Range During the First Decade of the Planning Horizon

Indicator	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Total Acres of Indiana Bat Primary Range on NFS Land	228,000	228,000	228,000	228,000	228,000
FRCC I, 3 and FRCC III, 2 Acres in MPs 3.0, 6.1, 6.3, 8.1, in Primary Range	48,000	50,000	50,000	43,000	51,000
Maximum Projected Acres of Prescribed Fire Treatment in Primary Range During the First Decade	800	7,600	7,600	1,000	18,000

Table TE-8 displays projected amounts of prescribed fire within Indiana bat primary range for the first decade. These projections assume that prescribed fire would be applied in high priority areas within primary range with the same priority level as similar areas outside of primary range. Because of goals and objectives to enhance habitat for endangered species, areas within primary range could have an even higher priority than other FRCC I, 3 and III, 2 areas, which could result in a larger amount of habitat treated. Conversely, budget and staffing limitations could result in smaller amounts of habitat treated.

Alternatives 1 and 3 would have little potential to improve primary range using prescribed fire, whereas Alternative 4 would increase prescribed fire in primary range to more than 20 times the currently allowed level. Alternatives 2 and 2M would increase prescribed fire in primary range substantially beyond current levels, but would still be far below the levels of Alternative 4. Although specific objectives for prescribed fire have not been formulated beyond the first decade of the planning horizon, similar amounts of prescribed fire are expected in subsequent decades.

Effects From Habitat Enhancement in Primary Range – Wildlife habitat restoration within Indiana bat primary range would be designed to improve or maintain bat habitat and would therefore have beneficial effects. Some of the attributes that characterize optimal Indiana bat habitat, such as larger trees and more snags, may be achieved simply by allowing stands to grow older over time. However, to maintain foraging and roosting habitat with a semi-open canopy and a fairly open mid-story would require a certain amount of management in most stands. These conditions would be created or maintained primarily through thinning or uneven-aged harvest. While such timber harvest would be designed to have beneficial effects on Indiana bat habitat, it could negatively affect potential roost trees, roosting individuals, or undiscovered maternity colonies. These negative effects are discussed below under the Timber Harvest section. Beneficial effects could include enhancement of roosting and foraging habitat by creating partial canopy openings. Thinning and uneven-aged harvest would have the added benefit of increasing the growth rate of the remaining trees, which contributes to the development of large-diameter potential roost trees.

The expected amount of harvesting for habitat enhancement in primary range was estimated based on Plan objectives for the first decade of the planning horizon (see Table TE-9). Only Alternative 2M has an explicit objective for Indiana bat habitat enhancement; however, similar habitat enhancement would be desirable under all alternatives. Habitat enhancement for the other alternatives was estimated by proportionally extrapolating the Alternative 2 objective to the areas of primary range that would be available for enhancement based on MP allocations and tentative timber suitability. During the first decade of the planning horizon, Alternatives 1, 2, 2M, and 4 would have similar amounts of habitat enhancement in primary range. The amount would be lower in Alternative 3 because of larger land allocations to MPs where silvicultural habitat treatments would be unlikely.

Table TE-9. Projected Acres of Silvicultural Habitat Enhancement in Indiana Bat Primary Range During the First Decade by Alternative

Indicator	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Total Acres of Indiana Bat Primary Range on NFS Land	228,000	228,000	228,000	228,000	228,000
Acres of Primary Range Where Silvicultural Habitat Enhancement would be Allowed	89,000	86,000	85,000	67,000	94,000
Maximum Projected Acres of Silvicultural Habitat Enhancement in Primary Range	7,300	7,100	7,000	5,500	7,700

Effects From Timber Harvest – Timber harvest within and outside of primary range could affect unknown maternity sites or roosting individuals, but surveys would be conducted prior to project implementation to try to identify any unknown sites. If a maternity site is discovered, protective measures would be determined at a site-specific level in cooperation with USFWS and WVDNR. Any roost trees discovered would be protected until they no longer serve as roost trees. Plan direction addressing leave trees and snag retention would help maintain essential habitat components and further reduce the likelihood of harming or killing a roosting bat. However, bats are highly mobile and roosting habitat often is ephemeral, so it is possible that some areas harboring roosting Indiana bats would not be discovered or protected by snag retention and leave tree direction. Therefore, the potential for harming a roosting bat cannot be eliminated for any timber harvest operation that occurs outside the hibernation period. Indiana bats on and near the MNF are known to use a wide variety of live and dead trees as roosts, and the density of roosting bats is not known. Therefore, it is not possible to estimate reliably the number of Indiana bats that are expected to be harmed or killed.

Timber harvest has the most potential of any activity for affecting habitat structure, particularly outside of primary range. For example, even-aged regeneration harvests would remove most of the forest canopy, which may not produce optimum foraging habitat for this species. Timber harvesting does not appear to discourage Indiana bats from using nearby trees as roosts, and in fact may make them more attractive by allowing more warming by solar radiation (USFWS 1999). However, the disturbance during timber cutting may temporarily displace bats from nearby roosts. Outside of primary range, timber harvests would not necessarily be beneficial for Indiana bat habitat, but negative effects to habitat would be minor because most roosting, foraging, and swarming activity is believed to occur within primary range.

Programmed timber harvest is harvest that occurs on suitable timber lands and is intended to progress toward desired conditions for timber production and age class diversity. Programmed harvest does not include silvicultural treatments in primary range or other habitat enhancement treatments. Total Forest-wide programmed timber harvest (regeneration and intermediate harvests combined) for the planning period would be highest under Alternative 1 and lowest under Alternative 3 (See Table TR-14 in the *Timber Supply* section of this chapter). Alternatives 2, 2M, and 4 would have intermediate harvest levels.

West Virginia Northern Flying Squirrel

It is expected that all of the alternatives would adequately protect WVNFS populations and habitat through Forest-wide and MP direction, as well as the ESA Section 7 consultation process with USFWS. See *General Effects to T&E Wildlife Species and Habitat* section, above.

Cheat Mountain Salamander

There would likely be no measurable direct or indirect effects to Cheat Mountain salamanders as a result of implementing any of the alternatives. See *General Effects to T&E Wildlife Species and Habitat* section, above.

Bald Eagle

There would likely be no measurable direct or indirect effects to bald eagles as a result of implementing any of the alternatives. See *General Effects to T&E Wildlife Species and Habitat* section, above.

Cumulative Effects for T&E Plant Species

For analysis of cumulative effects, both National Forest System lands and lands of other ownership within the proclamation boundary were considered. Past, present, and reasonably foreseeable actions on all lands were also considered.

The assumption is made that the Endangered Species Act and consultation processes will be followed for any projects implemented under the Forest Plan. Biological Assessments and Evaluations would be completed on all federal actions with the potential to affect T&E species or their habitats.

Past actions have created the habitat conditions present and described for each species. For the endemic species with narrowly defined habitat, the plants' rarity on the landscape is not likely a response of past actions. For RBC, for example, past actions of timber harvest and associated road construction have perpetuated assumed natural habitat of disturbance caused by bison or other large herbivores.

Outcomes from Terrestrial Plant Species Viability Evaluation

Estimates of viability related to the potential impacts of management were made based on the following viability factors: habitat abundance, habitat distribution and connectivity, and population factors. Ratings for each component were made along with confidence ratings for the viability factors. The outcomes for the four T&E plant species are given in Table TE-10.

Looking at the SVE outcomes provides a good estimate of potential cumulative effects. The outcomes were based on habitat and actions within the MNF boundary regardless of ownership. For a species to receive an outcome of ‘C’, ‘D’, or ‘E’, one of the three viability factors were rated in the high risk category. If all factors are ranked in the middle risk categories then a ‘C’ or ‘B’ outcome was assigned. For SBRC, habitat abundance was rated rare, causing an outcome of ‘C’. For RBC, all factors were in middle risk categories.

The most important aspect of the species viability evaluation is whether any alternative resulted in a different overall outcome than the current evaluation for an individual species, particularly a lower outcome, which would indicate a downward trend. For all of the species evaluated, the outcomes by alternative were the same as the current ratings, indicating that management strategies under all alternatives should not result in a downward trend in viability.

Table TE-10 – Viability Outcomes by Alternative from Fine-filter Species Viability Evaluations

Species	Current Rating	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Running buffalo clover	C	The outcome is the same for all alternatives: C – The species has low abundance and/or is distributed in a patchy pattern of disjunct occurrences. For species associated with unique habitats, low abundance and patchy distribution may be the natural condition. Many occurrences are isolated, whereas others are still able to interact as metapopulations.				
Small whorled pogonia	E	The outcome is the same for all alternatives: E – The species has a very low abundance and is distributed as isolated occurrences. Many occurrences have a strong potential for extirpation, and metapopulation interactions are not possible.				
Shale barren rockcress	C	The outcome is the same for all alternatives: C – The species has low abundance and/or is distributed in a patchy pattern of disjunct occurrences. For species associated with unique habitats, low abundance and patchy distribution may be the natural condition. Many occurrences are isolated, whereas others are still able to interact as metapopulations.				
Virginia spiraea	E	The outcome is the same for all alternatives: E – The species has a very low abundance and is distributed as isolated occurrences. Many occurrences have a strong potential for extirpation, and metapopulation interactions are not possible.				

Running Buffalo Clover

Although much potential habitat appears to exist on the MNF, specific light and disturbance requirements needed for RBC survival and spread are not always found with the proper soil and forest type components of its habitat.

Effects to Habitat – Modeled projections indicate a substantial increase in potential habitat for this species under all alternatives. Similar trends are expected on private land. Thus, the cumulative trend is an overall increase in potential habitat, with Forest management activities potentially contributing to a large portion of that increase.

Effects to Individuals – Timber harvest and associated road building have the potential to both negatively and positively affect population occurrences. Given harvest trends on private lands versus projected harvest levels on NFS lands, Forest management activities have the potential to make a substantial contribution to cumulative effects to this species. However, survey, mitigation, and monitoring requirements on NFS lands should provide adequate protection for any known or discovered populations on the Forest. Potential cumulative effects to this species would still include competition from non-native invasive species and altered natural disturbance regimes.

Small Whorled Pogonia

SWP is considered to have a large range, and the central Appalachians are well within that range. However, the viability outcome was based on the extremely limited distribution of the plant within what seems to be large areas of potential habitat. The rarity of this plant may suggest unknown micro-habitat requirements not reflected in the habitat ratings used for this evaluation.

Effects to Habitat – It is projected that there would be no substantial change from current levels in the overall amount of old and mature mixed mesophytic forest under any alternative. Hemlock forest may decrease due to wooly adelgid infestations, but reductions would not be the result of management strategies under any alternative. Therefore, little or no cumulative effects from management-related activities are expected to the available amount of potential habitat. Micro-habitat requirements are not well understood, and there is potential for changes in habitat structure as these forests age over time. What effects this would have on habitat potential are unknown, but they would occur on both NFS and private lands, with NFS land having a large contribution to the overall cumulative trend. This trend would be similar under all alternatives. There would be somewhat different levels of old forest under the alternatives, but not enough to vary the SVE habitat rating.

Effects to Individuals – The only known occurrence of this species is on NFS land in an area where timber harvest and associated activities are not allowed under any alternative. Thus, there is no potential for these activities to contribute to cumulative effects to this population under any alternative. Potential cumulative effects to this species would still include herbivory by deer, and collecting and damage from research activities.

Shale Barren Rockcress

SBRC is an endemic to shale barrens, a very rare community type, so low abundance and patchy distribution are likely the natural condition for this plant. The viability outcome of C was given over D due to known occurrences in habitat that are not imminently threatened.

Effects to Habitat and Individuals – See *General Effects to T&E Plant Species and Habitat* section, above. Because Forest-wide protection of shale barren areas under all alternatives would greatly reduce the potential for impacts to this species, there would be little or no potential for management-related impacts to this species or its habitat under all alternatives. Potential cumulative effects to the species still include deer herbivory and competition from non-native invasive species. Insect pollinators are vulnerable to Dimilin spraying for gypsy moth control.

Virginia Spiraea

Virginia spiraea is an endemic species with a relatively small range. Habitat connectivity is a concern for this plant since its distribution is limited to riparian areas. The viability outcome reflects its extremely limited distribution within potential habitat.

Effects to Habitat and Individuals - See *General Effects to T&E Plant Species and Habitat* section, above. Because Forest-wide protection of riparian areas under all alternatives would greatly reduce the potential for impacts to Virginia spiraea along streams and rivers, there would be little or no potential for management-related impacts to this species or its habitat under all alternatives. Potential cumulative effects to the species would still include large scouring floods, competition from native and non-native plants, and clearings made by recreationists.

Cumulative Effects for T&E Animal Species

For analysis of cumulative effects, both National Forest System lands and lands of other ownership within the Forest proclamation boundary were considered. Past, present, and reasonably foreseeable actions on all lands were also considered.

The assumption is made that the Endangered Species Act and consultation processes will be followed for any projects implemented under the Forest Plan. Biological Assessments and Evaluations would be completed on all federal actions with the potential to affect T&E species or their habitats.

Outcomes from Terrestrial Wildlife Species Viability Evaluation

Estimates of viability related to the potential impacts of management were made based on the following viability factors: habitat abundance, habitat distribution and connectivity, and population factors. Ratings for each component were made along with confidence ratings for the viability factors. The outcomes for the five T&E animal species are given in Table TE-11.

Table TE-11. Viability Outcomes for T&E Animal Species by Alternative

Species	Current Rating	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Virginia big-eared bat	C	The outcome is the same for all alternatives: C – Habitat is not projected to decline measurably in the foreseeable future, but ultimate habitat potential is limited by cave availability, physical structure, and microclimate. Overall outcome reflects low abundance and inherent risk posed by dependence of most of the area population on 11 major caves. Movement between caves should be possible for metapopulation.				
Indiana bat	D	The outcome is the same for all alternatives: D – The outcome reflects the high risk associated with having almost all of the regional hibernating population concentrated in one hibernaculum. Favorable foraging and roosting habitat conditions are projected to increase substantially under all alternatives. However, potential abundance ultimately is limited by availability of suitable hibernacula.				

Species	Current Rating	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
WV northern flying squirrel	C	The outcome is the same for all alternatives: C – The outcome reflects low abundance and presumed fragmentation of high-elevation habitat. Habitat is expected to increase substantially under all alternatives due to specific Plan land allocation and management direction for protection.				
Cheat Mountain salamander	D	The outcome is the same for all alternatives: D – The outcome reflects the limited species range and dramatic reduction in historical habitat. Habitat is expected to increase substantially under all alternatives due to specific Plan land allocation and management direction for protection, but substantial uncertainty exists over the species' ability to colonize new habitat.				
Bald eagle	D	The outcome is the same for all alternatives: D – Although populations are recovering nationwide, the low outcome reflects very low breeding density on the Forest. Riparian forests are protected by Plan direction, and suitability for nesting should increase as these forests grow older and large trees become more abundant. Foraging habitat availability is not expected to change much.				

The important aspect of the viability evaluation is whether the evaluation for any alternative resulted in a different overall outcome than the current evaluation for an individual species, particularly a lower outcome, which would indicate a downward trend. For all of the species evaluated, the outcomes by alternative were the same as the current ratings, indicating that management strategies under all alternatives should not result in a downward viability trend.

Virginia Big-eared Bat

Effects to Habitat – The majority of Virginia big-eared bat foraging area is private land that is a mixture of habitats consisting of forests, pastures, and other agricultural uses. Data contained in the *Census of Agriculture* (USDA 2004, 1999) suggest that there has been little recent change in the acreage of agricultural land in the counties that contain the MNF. For private forest land, data from the Forest Service's Forest Inventory and Analysis database suggest a slightly increasing trend in sawtimber acreage and a slightly decreasing trend in poletimber and seedling/sapling acreage (data from FIA website). Combined with the projected small changes in herbaceous openings and the projected small increases in seedling/sapling forest on NFS land, no major cumulative change in foraging habitat is expected in the foreseeable future under any alternative.

Vandalism and cave visitation has resulted in destruction of habitat and disturbance to individuals for many bat colonies (USFWS 1984). Habitat reduction may also occur after natural disasters (flooding, cave subsidence), cave commercialization, and alterations of airflow into caves due to poorly designed and installed cave gates or naturally caused blockages in cave passages. Increased popularity of spelunking on private land could create a shift to increased use of MNF caves. Increased recreational use of MNF caves could contribute to the cumulative effects of cave habitat alteration, though the potential extent and severity of such alteration is difficult to predict. However, hibernacula and summer colonies on NFS lands are protected by closure orders, Forest Plan direction, and the Cave Resources Protection Act, so National Forest management and authorized recreational use contributions to these cumulative effects are considered extremely unlikely for all alternatives.

Effects to Individuals – Hibernating and summer-roosting Virginia big-eared bats, especially females with young, are at risk from human disturbance. During hibernation, disturbances can cause bats to expend fat reserves with no opportunities to replenish during the winter months. During maternity season, young are at risk if the colony is disturbed. Although important hibernacula and summer colonies are gated and closed to protect imperiled bats, gating every potential hibernaculum in the state would be logistically and legally impossible. Thus, unrestricted spelunking across West Virginia could have negative effects on Virginia big-eared bats in the future. However, Forest-wide direction for all alternatives prohibits public entry into major Virginia big-eared bat caves when the bats are present. Therefore, given these standards, there is little potential for authorized recreational activities on the MNF to contribute to these cumulative effects.

Historic collecting, handling, banding and counting individuals during hibernation or maternity season also have contributed to population declines over the years (USFWS 1984). Continued scientific activities, such as hibernacula/maternity surveys, mist netting, and trapping, have the potential to harm bats. Forest Plan direction for all alternatives requires Forest Supervisor approval and the appropriate USFWS permits for scientific studies in caves during closed periods, and the ESA and its implementing regulations require permits and use of qualified personnel for mist netting and trapping. It is expected that such approvals and permits will make contributions by the MNF to such cumulative effects extremely unlikely.

Several animals—including cats, owls, hawks, raccoons, skunks and snakes—are known to prey on bats. Many such small and medium-sized predators are known to frequent edge habitats such as those created by agriculture or forest management activities. However, under all alternatives plan direction prohibits most vegetation management within 200 feet of Virginia big-eared bat cave entrances, which is expected to make MNF contributions to such effects extremely unlikely. Gates and barriers used to prevent human access to caves can also contribute to predation by causing bats to slow down and circle prior to entering the cave. Methods have been devised to avoid this problem, such as moving gates a short distance inside the cave entrance so the circling occurs in an area that is too dark to allow successful predation. Therefore, any new gates or barriers are not expected to make a measurable contribution to the cumulative effects of predation.

Currently there are three private quarries operating near occupied Virginia big-eared bat caves. Expansions of these quarries, new quarries, or other private mineral developments have the potential to adversely affect Virginia big-eared bat individuals or their habitat. Forest-wide direction for all alternatives prohibits surface occupancy for federal mineral operations within 200 feet of Virginia big-eared bat caves. Plan direction also limits seismic exploration and use of explosives to those areas where such activities will not adversely affect Virginia big-eared bats or their cave habitat. This direction is expected to eliminate the potential for the MNF to contribute to the cumulative effects of mineral exploration and development.

Wind power development on private land could result in harm or mortality to Virginia big-eared bats. The existing threat is believed to be low because the only currently operating wind generation facility in the vicinity of the MNF is not located near any Virginia big-eared bat hibernacula or summer colonies. However, a proposed facility outside the MNF in Pendleton

County falls within the 6-mile foraging habitat circles associated with several Virginia big-eared bat caves, including Minor Rexrode Cave, which serves as a bachelor colony and hibernaculum for hundreds of Virginia big-eared bats. Other permitted (but not yet constructed) wind power facilities in Grant County would not fall within any of the foraging habitat circles that overlap the MNF proclamation boundary. There have been no formal proposals for wind energy development on MNF land, so foreseeable MNF activities would not contribute to cumulative harm and mortality due to wind power development. The 2006 Forest Plan does not specifically restrict wind power, although plan direction for special uses would apply to any proposed wind power development on MNF land. Because there is no existing or proposed wind energy development on the MNF, and because the 2006 Forest Plan contains no goals or objectives for wind energy, any attempt to analyze the effects at the programmatic level would be speculative.

Indiana Bat

Effects to Habitat – Based on MP allocations and management direction, all Forest Plan alternatives would have the potential to maintain or improve foraging and roosting conditions in Indiana bat primary range. Given harvest trends on private lands versus projected harvest levels and special protections for Indiana bats on NFS lands, Forest management activities have the potential to make a positive cumulative contribution to maintenance and enhancement of habitat for this species.

Vandalism of caves and cave gates has the potential to damage hibernacula. Damage to hibernacula may also occur due to natural disasters (flooding, cave subsidence), cave commercialization, and alterations of airflow into caves due to poorly designed and installed cave gates or naturally caused blockages in cave passages. Increased popularity of spelunking on private land could create a shift to increased use of MNF caves. Increased recreational use of MNF caves could contribute to the cumulative effects of alterations to cave habitat, though the potential extent and severity of such alteration is difficult to predict. However, hibernacula on NFS lands are protected by closure orders, Forest Plan direction, and the Cave Resources Protection Act, so there is little or no potential for National Forest management and authorized recreational use to contribute to these cumulative effects.

Effects to Individuals – Hibernating Indiana bats are at risk from disturbance by many of the same agents discussed above for Virginia big-eared bat, including recreational disturbance, scientific disturbance, predation, and mineral development. On NFS land, Indiana bats are protected from these agents by direction similar to that for Virginia big-eared bats. This plan direction is expected to eliminate or minimize the MNF's potential to contribute to the cumulative effects of these agents.

In addition to risks associated with activities near hibernacula, there is a risk of bat injury or mortality posed by tree felling and prescribed fires. The 2006 Forest Plan would provide areas where little or no vegetation management would occur; the risk of bat injury or mortality from management-related activities would be minimal or nonexistent in these areas. Continued Forest-wide monitoring of Indiana bats, along with plan direction to protect maternity colonies, roost trees, and many potential roost trees, would help to identify and protect maternity colonies and roost trees in areas where active vegetation management occurs. This protection further reduces the potential for harm or mortality of individuals. In contrast, vegetation management on private lands typically has few safeguards to minimize take, so it is expected that, per acre harvested or burned, private management actions have a much greater potential for harming or killing roosting Indiana bats. However, the expected amount of timber harvest on private land cannot be estimated. Also, Indiana bats in the vicinity of the MNF are known to use a wide variety of live and dead trees as roosts, and the density of roosting bats is not known. Therefore, it is not possible to estimate reliably the cumulative number of Indiana bats that are expected to be harmed or killed.

Wind power development on private land could result in harm or mortality to Indiana bats. The existing threat is believed to be low because the only currently operating wind generation facility in the vicinity of the MNF is not located near any Indiana bat hibernacula. However, a proposed facility outside the MNF in Pendleton County would be very near the southern edge of the primary range circle associated with Trout Cave. The northern edge of this primary range circle includes a small amount of NFS land and additional non-NFS land within the proclamation boundary. Other permitted (but not yet constructed) wind power facilities in Grant County would not fall within any of the primary range circles that overlap the MNF proclamation boundary. As noted above in the Cumulative Effects section for Virginia big-eared bat, the 2006 Forest Plan contains no goals or objectives for wind energy, and any attempt to analyze the effects at the programmatic level would be speculative.

West Virginia Northern Flying Squirrel

Effects to Habitat – Because most WVNFS habitat is on NFS lands on the MNF, timber harvests and other development outside the MNF would have limited effects on WVNFS habitat. However, negative effects due to development or timber harvest could occur on the small fraction of habitat on private land. Due to protections for suitable habitat under all alternatives, MNF management activities have little or no potential to make a measurable contribution to any such negative cumulative impacts.

Continued acid and heavy metal deposition due to industrial activities outside the MNF could reduce future spruce abundance or change soil pH enough to alter fungal growth and availability (a primary food source for WVNFS). MNF activities do not contribute to these pollution sources, and protections for suitable habitat under all alternatives would greatly limit the potential for timber removal from NFS lands to contribute to any nutrient depletion associated with atmospheric deposition.

Suitable habitat is expected to increase substantially due to continued maturing of second growth forests, land allocation to MP 4.1 spruce restoration areas under the action alternatives, and Forest-wide direction for protection of suitable habitat. Thus, Forest management activities should have overall positive cumulative effects on WVNFS habitat.

Effects to Individuals – Effects to individuals generally involve direct harm or mortality in association with activities that alter or destroy occupied habitat. Because NFS lands on the MNF contain a large majority of habitat for the squirrel, activities on non-NFS lands have limited potential for affecting individuals. However, such effects could occur in conjunction with development or timber harvest on the small fraction of habitat that is not on NFS lands. Due to protections for suitable habitat in all plan alternatives, MNF management activities have little or no potential to make a measurable contribution to any such negative cumulative impacts.

Cheat Mountain Salamander

Current levels of Cheat Mountain salamander populations are likely a result of the extensive logging of their spruce habitat in the early 1900s. With an estimated 88 percent of populations within the MNF boundary (Pauley pers. comm. 1999), timber harvesting and other activities on non-NFS land would have limited potential for broad-scale effects on Cheat Mountain salamander habitat and populations. However, negative effects to habitat and populations on non-NFS lands could occur, particularly due to residential/resort development and timber harvesting on private land. Other sources of cumulative effects to habitat or individuals include competition from other plethodontids, predation, and altered soil chemistry due to acid deposition. Because of the protections contained in the 2006 Forest Plan, MNF management would not have the potential to make a measurable contribution to these cumulative negative effects.

Bald Eagle

Activities off of NFS land have the potential to affect bald eagle habitat and individuals. Timber harvest and land development for a variety of uses have the potential to degrade or eliminate potential nesting and foraging habitat. Passive management on private land also has the potential to improve nesting and foraging habitat. ESA take prohibitions protect nest sites even on private land, but the potential for negligent or malicious destruction of nest sites still exists. Direct harassment or harm to individuals, both negligent and intentional, also could affect bald eagles on all land ownerships despite ESA take prohibitions. Taken cumulatively, all of these activities have the potential to negatively affect bald eagle habitat, individuals, and populations. However, given the protections contained in Forest Plan direction, which are likely to reduce potential adverse direct and indirect effects of MNF management to a negligible level, MNF management has little or no potential to contribute to cumulative negative effects. Conversely, MNF protection of nest sites, potential riparian nesting habitat, and aquatic foraging areas would likely make a substantial contribution to beneficial cumulative effects.

Summary

Implementation of the alternatives would result in various levels of timber harvest, road construction, road reconstruction, road abandonment, recreational development and use, and non-commercial manipulation of vegetation. Taken alone or together, these actions could have effects on T&E species and their habitats, both negative and positive. However, protection of T&E populations and their habitats is a priority in the 2006 Forest Plan. This protection is achieved through surveys for individuals, management requirements and mitigation measures designed to avoid or minimize effects, special designations and management strategies for known habitat, monitoring of potential effects, and consultation with the US Fish and Wildlife Service. With implementation of these resource protection methods, any cumulative adverse effects to the T&E species described in this section should be avoided or minimized.

Non-native Invasive Plant Species

INTRODUCTION

Non-native invasive species (NNIS) were identified as a minor Need for Change issue. Approaches to address NNIS are also included in the Vegetation Management major Need for Change issue.

NNIS have been recognized as a major threat to conservation of native biological diversity (Westbrooks 1998). NNIS out-compete native species and homogenize ecosystems, thereby threatening to destroy the distinctiveness of communities whose component species evolved in the absence of these aggressive competitors. NNIS can also degrade forage quality on range lands, compete with desirable regeneration after timber harvest, and reduce the diversity of habitat niches available to a wide variety of wildlife species.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect the spread and control of NNIS.

Background

NNIS have been recognized at the national level as one of the four major threats to the ecological sustainability of National Forest Systems (NFS) land. NNIS spread via a variety of pathways. For most species, invasion and spread are facilitated by some type of human-caused habitat alteration, especially those alterations that include soil disturbance. Typical alterations that can encourage NNIS include roads, hiking and horse trails, grazing allotments, utility corridors, wildlife openings, and vegetation management. Some of these factors, such as trails, grazing allotments, and utility corridors, are not likely to change much by alternative. However, road construction and wildlife opening construction are likely to vary according to the amount of land that is allocated to MPs that emphasize vegetation management. Road construction is directly related to the amount of timber harvesting that is conducted in areas that do not already have adequate access.

Indicators

Amount of timber harvest 3/8 of a mile or more from currently existing roads by alternative - As an index to the risk of invasion and spread of NNIS plants, we projected the acreage of timber harvest in areas that are 3/8 of a mile or more from the nearest currently existing system road or state-maintained road. Generally, harvest units that have system road access within 3/8 of a mile do not require construction of new system or temporary roads. Areas within 3/8 of a mile of a system road were considered to be already vulnerable to NNIS; timber harvest activity outside this accessible area was considered to be an index to areas that may become more susceptible due to management. Acreage of timber harvest 3/8 of a mile or more from the nearest road was projected by Spectrum modeling. Although harvests that use helicopter yarding of logs generally require less road construction than conventional harvests and, therefore, have less potential for facilitating NNIS invasion and spread, we did not separate the indicator by yarding method. Specific information on site limitations is necessary to determine where helicopter yarding is needed, but such information was not available to use in the model, so the model had no basis for projecting the locations of helicopter harvests in relation to existing roads. Therefore, this indicator should be considered an index to potential NNIS invasion and spread associated with new roads, rather than a precise estimate of acreage to be affected by new roads.

Amount of maintained openings by alternative - As an additional indicator of vulnerability to NNIS invasion and spread, we tracked the predicted amount of maintained openings by alternative. We used the estimated future amounts of the high elevation grasslands community and the woodlands, savannas, and grasslands community to approximate maintained openings (see *Terrestrial Ecosystem Diversity* section of Chapter 3). Total acreage of maintained openings was projected by assuming that the mid-range goal of 5 percent maintained openings will be met in MPs 2.0, 3.0, 4.0, 4.1, 6.1, and 6.3, outside of suitable West Virginia northern flying squirrel habitat.

Scope of Analysis

Projected amounts of the indicators were assessed through the 100-year planning horizon. Analysis over the entire planning horizon allowed us to evaluate potential temporal differences in the amount of harvesting in areas more than 3/8 of a mile from roads. Limiting the analysis to the early decades of the planning horizon would have ignored any potential changes over time in the spatial pattern of harvesting relative to existing roads. However, projections beyond the first decade or two must be viewed with caution because of the potential for changes in management emphasis and harvest methods, as well as substantial uncertainty over factors beyond the control of the Forest, such as continued acid deposition, global climate change, human population growth, and arrival of new NNIS.

For direct and indirect effects, the indicators were analyzed for all NFS land within the Forest boundary. For the cumulative effects discussion, we considered potential activities on other land ownerships within the Forest boundary. Potential activities on other ownerships could not be quantified reliably, so the cumulative effects analysis is a qualitative discussion of the extent to which Forest Service activities are likely to contribute to overall NNIS risk within the Forest boundary.

These indicators are interpreted as indicators of the potential for invasion and spread of terrestrial plant NNIS. Insect and pathogen NNIS are discussed in the context of forest health in the *Vegetation Management* section of Chapter 3. Aquatic NNIS are discussed in the *Water, Aquatic, and Riparian* section of Chapter 3. Invasive terrestrial vertebrates currently are not a serious problem on the Forest and are not analyzed in detail.

CURRENT CONDITIONS

Currently, 95 species of NNIS plants are known or suspected to occur on the Forest (Ecology AMS, Forest Plan Project record). Of these species, 22 are considered highly invasive, with the potential to invade natural habitats and replace native species. These include species that are well-known for seriously disrupting the plant species composition of forested communities, such as tree of heaven (*Ailanthus altissima*), garlic mustard (*Alliaria petiolata*), Tartarian honeysuckle (*Lonicera tatarica*), and Japanese stiltgrass (*Microstegium vimineum*). Thirty-one species primarily occur in disturbed areas, but are capable of spreading into adjacent undisturbed areas. These include many agricultural weeds and domestic plants that have escaped cultivation, such as Japanese barberry (*Berberis thunbergii*), tall fescue (*Festuca elatior*), yellow sweet clover (*Melilotus officinalis*), and princess-tree (*Paulownia tomentosa*). Twenty-seven species have less invasive potential, and are generally found in disturbed areas with full sun or partial shade. These include many naturalized species like Queen Anne's lace (*Daucus carota*), English plantain (*Plantago lanceolata*), and curly dock (*Rumex crispus*). The remaining 15 species are known to be invasive elsewhere, but their invasive potential on the Forest is not known.

No comprehensive survey of invasive plants has been conducted on the Forest, although NNIS plants are often included in project-level surveys for threatened, endangered, and sensitive plants. During the late 1990s, Candidate Research Natural Areas and grazing allotments totaling several thousand acres were surveyed for NNIS, but no representative sampling effort that would allow estimation on a Forest-wide basis has been attempted. Therefore, the full extent and severity of NNIS infestation is not known.

Currently over 350,000 acres of NFS land lie within 3/8 of a mile of a system road. This comprises about 39 percent of all NFS land. There are approximately 21,000 acres of herbaceous openings on NFS land, as measured by the high elevation grasslands and woodlands, savannas and grasslands communities (see *Ecosystem Diversity* section of this chapter). This comprises about 2 percent of all NFS land. There likely is some overlap with the land within 3/8 of a mile of a road, but openings comprise such a small percentage of land that the overlap is not a substantial factor in the evaluation of these indicators. These areas represent a rough index of land that may be most susceptible to new infestations of NNIS plants.

ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Laws, Regulations, and Policies

Numerous laws, regulations, and policies govern the management of NNIS on National Forest System lands. National laws and regulations have also been interpreted for implementation in the Forest Service Manual and Handbook. Some of the more influential laws, regulations, and policies governing management of NNIS are listed in Table IS-1 below:

Table IS-1. Major Laws, Policies, and Regulations Influencing Management of NNIS on National Forest System Land

Act/Law/Regulation/Policy	Law/CFR/FSM/FSH Number
National Forest Management Act	16 U.S.C. 1600-1614
National Forest Planning Regulations – diversity requirements	36 CFR 219.26, 36 CFR 219.27(g)
Lacey Act	18 U.S.C. 42
Federal Plant Pest Act	7 U.S.C. 150aa
Federal Noxious Weed Act	7 U.S.C. 2801
Executive Order on Invasive Species	E.O. 13112
USDA noxious weed regulations	Departmental Regulation 9500-10
Forest Service Directives on noxious weeds	FSM 2080
Forest Service National Strategy and Implementation Plan for Invasive Species Management	U.S. Forest Service 2004
Forest Service Eastern Region Non-native Invasive Species Framework	U.S. Forest Service 2003
Forest Service Eastern Region Native Plant Framework	U.S. Forest Service 2004

Forest Plan Direction and Implementation

The revised Forest-wide direction was developed within the context of national and regional guidance on NNIS management (see last three references in Table IS-1). This guidance prohibits the use of NNIS species in revegetation and stabilization work, and encourages efforts to slow or prevent NNIS spread. The guidance emphasizes prevention, early detection/rapid response, control/management, and rehabilitation/restoration.

Forest Plan direction for NNIS management does not vary much across the Management Prescriptions (MPs); therefore most NNIS direction is contained in the Forest-wide direction. Treatment of NNIS in the plan direction differs greatly between the 1986 Forest Plan and the revised management direction. NNIS were not considered a major management problem at the time the 1986 Forest Plan was written, so there is very little direction in the 1986 Forest Plan to address NNIS. In the 1986 Forest Plan, the Forest-wide direction contains one general statement calling for managers to favor native species when revegetating disturbed areas. MP 6.1 in the 1986 Forest Plan contains one standard requiring case-by-case analysis prior to planting exotic plants on range allotments.

In contrast, the revised 2006 Forest-wide direction contains several goals, standards, and guidelines that address NNIS. The most extensive is a goal outlining an integrated pest management approach toward NNIS management. This goal calls for prevention of new infestations, preparation of a Forest-wide NNIS management plan, project-level evaluation and implementation of NNIS management, and cooperative work with users of NFS land to control NNIS. The 2006 Forest-wide direction requires inspection of gravel and borrow sources for NNIS prior to use, and a new goal in the direction calls for developing sources for weed-free mulch to use in erosion control and revegetation work. The revised direction requires that projects with the potential to contribute to the spread or establishment of NNIS include mitigation measures to reduce the risk, and it calls for including language in special use permits to reduce the risk of NNIS invasion and spread. Other direction describes general items to consider when developing site-specific NNIS management strategies.

Effects Common to All Alternatives

All of the action alternatives are subject to plan direction that calls for reducing the risk of NNIS invasion and spread on all projects. Thus the NNIS risks discussed below probably are somewhat greater under Alternative 1 (no action) than under the action alternatives. However, the risks cannot be completely eliminated under any alternative.

Mineral Exploration, Development, and Leasing

Natural gas leasing is the most common form of mineral development on the Forest. Typically it disturbs only minor amounts of land in any given area, but the roads, pipelines, and clearings associated with gas production present an opportunity for NNIS invasion and spread. Because the NNIS indicator focuses on timber harvest operations, it does not measure the increased risk due to gas development. However, evaluation of the typical disturbance associated with gas wells gives some idea of the potential risk. Maximum gas well density in areas that are developed typically is about one well per square mile. An estimated 15.5 acres of clearing are associated with each gas well, most of which constitutes pipeline clearing. Because pipelines are linear features, they can provide travel corridors for NNIS plants. However, monitoring on the Forest has shown that typical pipeline corridors are narrow, and the tree canopy usually closes over them three to five years following disturbance. Therefore, shade-intolerant NNIS have a very short window of opportunity to invade along gas pipeline corridors. After canopy closure over the pipeline, a typical operation involves approximately two acres of well-site clearing and two acres of access road that remain open. If shade tolerant NNIS become established in any of the disturbed areas, they may invade surrounding forested areas.

Development of other federal minerals currently is rare on the Forest, but such development could occur in the future under any of the plan alternatives. Effects from development of minerals other than gas are difficult to predict because they vary depending on the mineral being developed, recovery methods (subsurface vs. surface mining), the intensity of surface disturbance, and the effectiveness of reclamation. However, any mineral development activity is likely to involve at least some ground disturbance that will increase the risk of NNIS invasion and spread. The level of risk will increase in proportion to the amount of the disturbance.

Vegetation/Timber Management – Mechanical Treatments

The primary risk of NNIS invasion and spread from mechanical vegetation management is associated with the roads that are necessary for access. The effects due to timber harvest access roads will be analyzed by alternative later in this chapter.

Other aspects of mechanical vegetation management that affect NNIS risk include log landings, skid trails, and the openings that result from even-aged regeneration cuts. All of these features provide possible invasion points for NNIS that prefer full sun or partial shade, and they may allow previously established NNIS to spread. Log landings, skid trails, and harvest areas may be traversed by mechanical equipment that can spread NNIS seeds or plant parts. The tree canopy will eventually close over all of these openings, which will limit further invasion and spread of shade-intolerant NNIS. However, if shade-tolerant NNIS become established, they may persist and invade the surrounding forest.

Vegetation/Timber Management – Salvage Harvest

Effects due to salvage harvest are similar to those from other forms of vegetation management. However, if harvest activities facilitate NNIS invasion, salvage areas have the added risk of being open due to prior natural disturbance. Therefore, larger areas may be at risk of invasion by shade-intolerant NNIS. The extent and intensity of effects due to salvage harvesting is impossible to predict because the amount of salvage harvesting is dependent on unpredictable natural disturbances.

Range Management – Livestock Grazing

Range allotments are particularly vulnerable to NNIS invasion and spread. Because they are maintained in a permanently open state, they are always at risk of invasion by shade-intolerant NNIS. Also, hay, livestock feed, manure, and agricultural vehicles and equipment can facilitate entry by NNIS seeds and plant parts. However, range management is not expected to expand in the foreseeable future. Acreage devoted to range allotments has been declining slowly over several decades, and the revised Forest-wide management direction calls for maintenance of existing grazing capacity. Based on current trends and the revised management direction emphasis, new allotments likely would be limited to newly acquired lands that contain pastures. Therefore, range management is not likely to create any new disturbed areas that would be vulnerable to NNIS invasion and spread. If the decline in range acreage continues, some range land would be replaced by forested habitat, which could reduce the risk of NNIS invasion and spread.

Fire Management – Fire Suppression

Fire suppression activities cause ground disturbances (e.g., fire lines), which can serve as invasion pathways for NNIS. This invasion risk would be managed by prompt rehabilitation of disturbed areas using non-invasive plants, generally local native species when they are available and practical to use. Fire suppression in fire-maintained landscapes has the potential to worsen invasion and spread of fire-sensitive NNIS. However, fire suppression can also prevent catastrophic disturbance by wildfire, which potentially can open up large areas to NNIS invasion and spread. The extent and intensity of these effects is difficult to predict because of the unpredictability of wildfires.

Fire Management – Prescribed Fire Use

Like fire suppression, prescribed fire use involves ground-disturbing fire lines that can act as NNIS invasion pathways. Prescribed fire can inhibit the invasion and spread of fire-sensitive NNIS, but it can also expose soil to potential new invasions of opportunistic NNIS. An objective in the 2006 Forest Plan direction calls for using prescribed fire on 10,000 to 30,000 acres over the next decade, but the degree of increased or decreased risk of NNIS invasion and spread within that area depends on site-specific factors that cannot be quantified accurately through a Forest-wide analysis.

Roads – Construction, Reconstruction, Maintenance, and Decommissioning

Roads constitute one of the major pathways for NNIS invasion and spread, which is why the NNIS indicator focuses on timber management that requires the construction of new roads. Risks due to road construction and reconstruction differ by alternative and are discussed later in this chapter. Road maintenance perpetuates roads as potential invasion corridors, and the equipment used to maintain roads can spread NNIS seeds and plant parts.

Road decommissioning, which is not reflected in the indicator that is analyzed later in the chapter, can reduce NNIS invasion risk by eliminating roads as potential invasion corridors. Road decommissioning also has the potential to control or eliminate established NNIS occurrences along existing roads. However, if road decommissioning involves seeding, mulching, and use of heavy equipment, NNIS seeds and plant parts could be introduced. Shade-intolerant NNIS would persist only until the tree canopy closes, but shade-tolerant NNIS could persist longer and spread into surrounding forested areas.

Recreation – Developed Recreation

Developed recreation sites create a risk of NNIS invasion and spread wherever they disturb ground. Developed facilities also attract large numbers of visitors, who can spread NNIS seeds or plant parts on their vehicles, pets, and clothing. However, developed recreation sites are expected to cover a small fraction of National Forest System land under all alternatives. The main risk of NNIS invasion and spread due to developed recreation probably would be limited to the vicinity of these sites, and therefore is not likely to affect a substantial portion of the Forest.

Recreation – Dispersed Recreation

Facilities associated with dispersed recreation (e.g., foot bridges, pit toilets) do not disturb much land, so they have very limited potential for facilitating invasion and spread of shade-intolerant NNIS. In contrast, trails through forested areas can serve as dispersal corridors and establishment sites for shade-tolerant NNIS, potentially affecting large areas of land. Seeds and plant parts can be transported along these trails by hiking boots, bicycles, horses, and pets. However, 2006 Plan direction gives priority to maintenance of existing trails over construction of new trails, and the current trail system has been difficult for the Forest to maintain in recent years. If this trend continues, substantial new trail construction is not likely, and the potential for NNIS spread due to dispersed recreation would be limited mostly to existing trails.

Recreation – Motorized Recreation Use

Effects associated with motorized recreation are largely due to the roads that are necessary to facilitate motorized access. Because roads are rarely constructed solely for motorized recreational use, motorized recreation is likely to occur on roads that would have been constructed anyway for management access reasons. Effects due to roads are analyzed by alternative later in this analysis.

Although motorized recreational use likely will not require much road construction beyond that needed for management access, motorized recreation use could increase the risk of NNIS invasion and spread beyond the risk associated with management-related use of the roads. Motorized recreational use could increase the number of vehicles using the roads, which increases the chances of spreading NNIS seeds and plant parts. Also, public vehicles would not be subject to any inspection or cleaning prior to entering NFS land, so there is no opportunity to mitigate the potential for spread. MP 3.0, which emphasizes motorized recreation, would have the highest potential for NNIS invasion and spread due to public vehicles.

Soil, Water, Riparian, Aquatic – Active Restoration

Active soil, water, riparian, and aquatic restoration has the potential to spread NNIS through the use of contaminated mulch or seeds in revegetation activities, although direction to use weed-free seed and favor native species would lessen this risk. However, active restoration is likely to affect a very small fraction of National Forest System land, so the potential for spread is likely to be minor. Active restoration could contribute to the control of NNIS by reforesting disturbed areas that might otherwise be vulnerable to NNIS invasion and spread.

Soil, Water, Riparian, Aquatic – Passive Restoration

Passive soil, water, riparian, and aquatic restoration generally does not involve use of seeds or mulch, so it has no potential to contribute to NNIS invasion and spread. Passive restoration that involves reforestation could help control NNIS by restoring areas that might otherwise be vulnerable to NNIS, although reforestation would likely be an exception rather than the rule.

Wildlife/Fish Habitat Restoration

Construction of new wildlife openings and savannas creates new areas of disturbed ground that are vulnerable to NNIS infestation. Seed and mulch used to establish vegetation on new openings can introduce NNIS seeds and plant parts, although plan direction requiring noxious weed-free seed would limit this risk to some extent. Tractors and brush hogs used to maintain openings can spread NNIS seed and plant parts from one opening to others. Shade-intolerant NNIS likely would be limited to the openings and immediately adjacent edge, but any shade-tolerant NNIS that become established in the openings could subsequently invade surrounding forested areas. The MPs that include new wildlife openings in the desired condition (2.0, 3.0, 4.0, 4.1, and 6.1) call for three to eight percent of the landscape in openings. For shade-intolerant NNIS, this would represent the maximum potential area that could become infested. Shade-tolerant NNIS, however, could spread beyond the openings, and the area that potentially could be affected is difficult to predict. Differences in wildlife openings by alternative are discussed later in this analysis.

Forested habitat restoration that reforests open areas has the potential to reduce establishment opportunities for NNIS plants. However, if it involves seeding, mulch, or use of mechanical equipment, it could introduce NNIS seeds or plant parts to the site. Any shade-intolerant NNIS would persist only until the forest canopy closes, but shade-tolerant NNIS could persist beyond canopy closure and invade surrounding forest. Restoration of habitat structure in forested areas also has the potential to introduce NNIS through the same pathways, although the vulnerability to shade-intolerant NNIS is lower. Thus, forested wildlife habitat restoration has the potential to reduce NNIS risk in some ways and raise it in other ways; the degree to which these two effects cancel each other out is difficult to predict.

Direct and Indirect Effects by Alternative

Amount of Timber Harvest 3/8 of a Mile or More from Currently Existing Roads

Acreage of timber harvest more than 3/8 of a mile from a currently existing road is projected to rise gradually during the planning horizon under all alternatives (Figure IS-1). Alternatives 1, 2, 2M, and 3 show a similar pattern of increasing acreage through the ninth or tenth decades, whereas acreage peaks under Alternative 4 in the sixth decade, with a generally declining trend thereafter. All alternatives show a fluctuating pattern within the overall trend. The generally increasing trend over time is driven by the model's objective to maximize value. Other factors being equal, one of the ways the model maximizes value is to harvest first in stands with the lowest costs, which generally means stands closest to existing roads. The pattern of harvesting in accessible stands first matches past management well, and it is reasonable to assume that the pattern will continue in the future. However, if resource issues that are not reflected in the model drive harvesting in less accessible areas early in the planning horizon, this indicator could understate the level of harvesting in less accessible areas in the early decades and overstate it in the later decades.

Despite the similar pattern across all alternatives, the amount of projected timber harvest more than 3/8 of a mile from an existing road does differ across alternatives (Figure IS-1). Alternative 1 has the highest amount in most decades, peaking at about 44,000 acres in the ninth decade. Alternative 3 has the lowest amount in most decades, with a peak of about 31,000 acres in the ninth decade. Under Alternatives 2 and 2M, the amount reaches its highest point of about 40,000 acres in the tenth decade, whereas Alternative 4 peaks at about 37,000 acres in the sixth decade. When the indicator is summed across the 10-decade planning horizon, Alternative 1 has a little more than 310,000 acres harvested beyond 3/8 of a mile from a currently existing road, which is the most of any alternative (Figure IS-2). Alternative 3 has the least, estimated at just over 180,000 acres. Alternatives 2, 2M, and 4 are intermediate at around 250,000 acres. According to this indicator, Alternative 1 would have the highest risk of facilitating the invasion and spread of NNIS plants, Alternatives 2, 2M, and 4 would have intermediate risk, and Alternative 3 would have the lowest risk.

It should be emphasized that this indicator only represents the amount of harvested land that is not near an existing road. It does not account for potential future decommissioning of roads, nor does it account for the possibility that harvests in later decades of the planning horizon may occur near roads that are built in the early decades of the planning horizon. Road decommissioning decisions are made as part of project-level analyses, so the extent of potential road decommissioning could not be predicted as part of this analysis. Therefore, this indicator should not be interpreted as a literal estimate of the amount of land that is susceptible to NNIS invasions and spread. Rather, it is merely a tool for comparing the relative risks of the alternatives.

Figure IS-1.

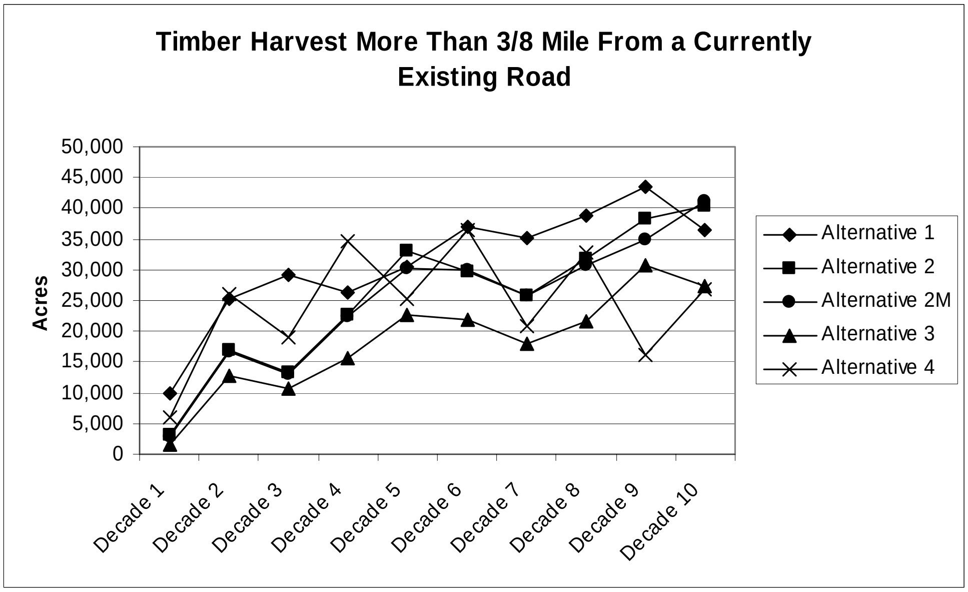
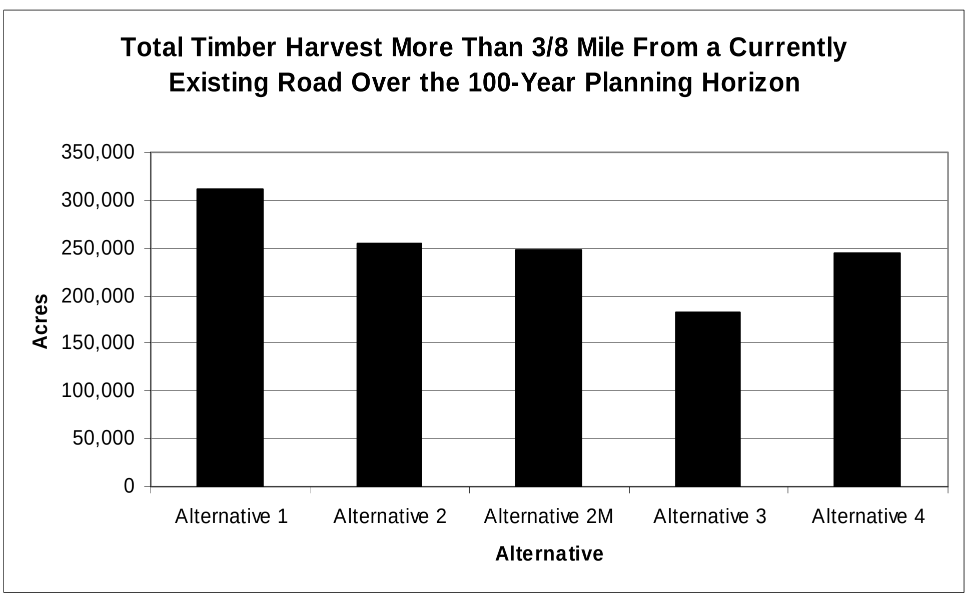


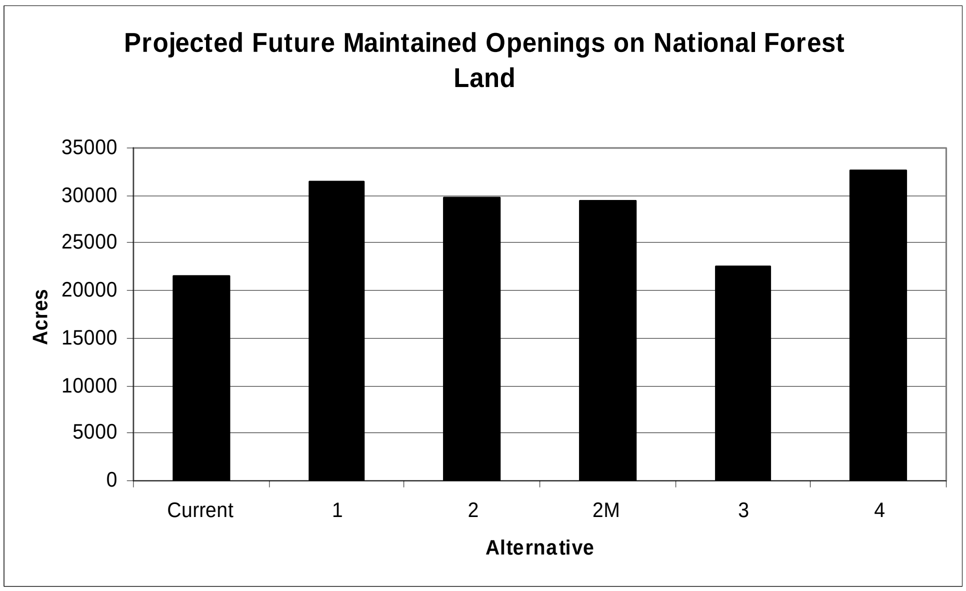
Figure IS-2.



Amount of Maintained Openings

The projected future amount of maintained openings differs across alternatives approximately in proportion to allocation of land to the suitable base MPs that have goals for creating and maintaining openings (Figure IS-3). Alternatives 1, 2, 2M, and 4 all have 30,000 to 33,000 acres of maintained openings, whereas Alternative 3 has about 23,000 acres. The projected future amounts under Alternatives 1, 2, 2M, and 4 all represent a noticeable increase from the current estimate of 22,000 acres. Based on this indicator, Alternatives 1, 2, 2M, and 4 would have a higher risk of facilitating invasion and spread of NNIS plants than Alternative 3.

Figure IS-3.

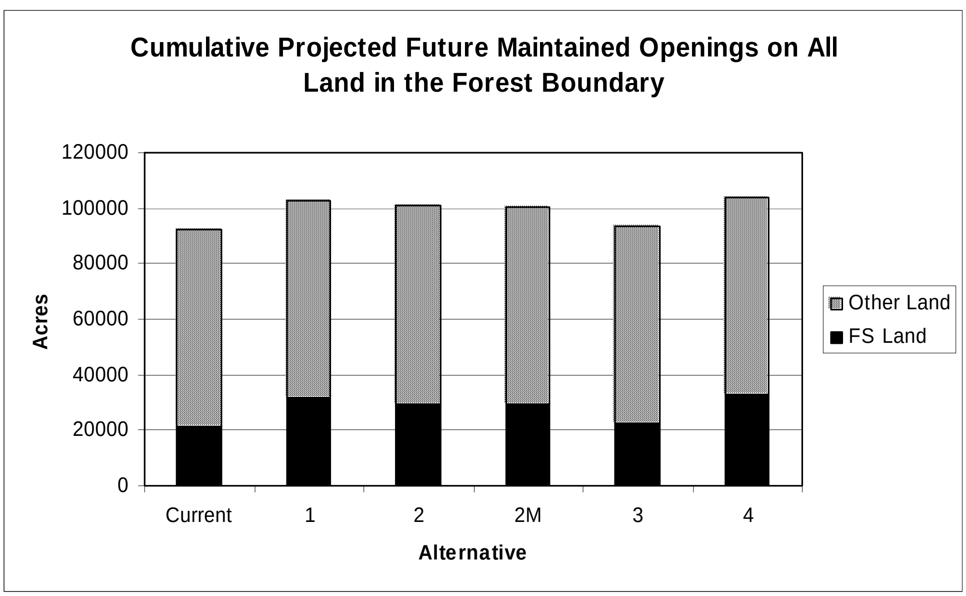


Cumulative Effects

The primary activities on non-NFS land that can facilitate NNIS invasion and spread include farming, timber harvest, mining, oil and gas development, residential development, and road/highway construction. Currently, there is far more open land on non-NFS land than on NFS land (about 72,000 acres versus 21,000 acres on NFS land, see *Terrestrial Ecosystem Diversity* section in this chapter). These openings on private land are mostly pasture and hay fields, which may have a high potential for invasion by NNIS due to recurrent disturbance, frequent farm equipment use, and livestock grazing. Based on data from the Census of Agriculture (USDA 2004, USDA 1999), the recent trend in hay and pasture land acreage has been flat in the counties that contain the Forest. If these trends continue, the risk associated with agricultural activities would be primarily that of invasions and spread on existing open land, rather than opening new land to invasions. Total area of herbaceous openings on NFS land is projected to range from 23,000 acres under Alternative 3 to 33,000 acres under Alternative 4. Assuming the amount of openings on non-NFS land stays similar to current amounts, the total amount of openings within the Forest boundary will range from about 95,000 acres (Alternative 3) to about 105,000 acres (Alternative 4) (Figure IS-4). This represents a 2 to 13 percent increase from the current amount. Thus, the Forest Service contribution to cumulative NNIS invasion potential in new open areas ranges from trivial under Alternative 3 to small, but not negligible, under Alternative 4. Due to protective measures that are likely to be implemented on NFS land, the Forest Service contribution to actual NNIS invasion risk should be less than the Forest Service proportion of the total acreage.

Cumulative NNIS invasion risk due to activities that do not involve maintained openings is much more difficult to predict. Timber harvest, mining, and oil and gas development are likely to occur on private lands, but the amount of these activities will depend on commodity prices, land owner economic needs, and the relative value of land for other uses such as residential development and real estate speculation. Such other land uses pose their own risks of NNIS invasion, particularly residential development, which involves access road construction, lawns, seeding, mulching, and use of ornamental plants that may have the potential to escape cultivation. Because most private land owners ultimately need to get some sort of economic return from their land, private land in general is expected to be more intensively used for a variety of activities than is NFS land. Therefore, it is likely that the bulk of the cumulative NNIS invasion risk within the Forest boundary will be due to activities on private land; however, Forest Service activities will contribute to this risk in ways that cannot be expressed proportional to the risk from private activities.

Figure IS-4.



Vegetation Management

INTRODUCTION

The Monongahela National Forest (MNF) is located within the ecological units of the Allegheny Mountains and Northern Ridge and Valley Sections of the Central Appalachian Broadleaf-Coniferous Forest Meadow Province. Elevation ranges from 900 feet to nearly 5,000 feet at the highest point in West Virginia on Spruce Knob. Due in large part to its geographic location in the mid-Atlantic and its mountainous terrain, the MNF is one of the most ecologically diverse forests in the National Forest System. The MNF contains the northern-most populations of certain southern species and the southern-most populations of certain northern species. Many of the 70+ species of trees found in the MNF are extremely valuable for commercial wood products as well as wildlife habitat. Particularly valuable for both lumber and food for wildlife are black cherry and northern red oak. Dozens of shrub and woody vine species and hundreds of herbaceous plant species provide diverse habitats, from early successional to late successional, for a wide variety of wildlife.

Native American Indians lived here for thousands of years, at first hunting, gathering, and using fire to drive game animals and clear the land. Later agricultural-based villages were located in the rich fertile valleys along stream courses. About 250 years ago European settlers began arriving in the area that is now the MNF. From around 1880 to 1930, widespread logging and fires set to clear land for grazing and subsistence farming combined to change the landscape. When the MNF was established in 1920, nearly all of the land was devoid of the original pre-settlement forest. The extensive timber harvesting, subsistence agriculture, and uncontrolled fires that occurred 75 -125 years ago created a generation of even-aged mature stand conditions on the Forest that are now in the mid-to-late successional stage. These past activities, along with planned management over the past 85 years and natural regeneration of the forest, have formed the mostly even-aged forest that is here today. Within the past 85 years this Forest has gone from the extreme of being a mostly early successional habitat forest in 1920 and is now trending toward a mostly late successional habitat forest. Neither a large amount of early successional habitat nor a large amount of late successional habitat can provide the diversity of plant and animal life to maintain a healthy forest over the long-term. Providing a more balanced distribution of age classes or successional stages would provide a more diverse and healthy forest while providing sustainable non-commercial and commercial resources and products for future generations.

Restoring the forest to pre-settlement conditions may not be attainable or desirable. Those habitats and species that presently occupy the land within the proclamation boundary of the MNF have adapted to human and natural disturbances. The result of the dramatic shift from the human-caused disturbances over the past 100+ years is indicative of the resilient and adaptive capability of this ecosystem. However, a combination of active and passive restoration management goals and objectives to provide a better distribution of declining or recovering forest types at the landscape level should maintain or enhance a healthy, sustainable, and diverse forest.

Need for Change

In the 1986 Forest Plan, rotation ages along with age and size class direction are identified in Management Prescriptions where active vegetation manipulation is allowed. These Management Prescriptions provide direction for the types of harvest methods that may be used to manage timber and other resources to meet long-term needs for a sustainable supply of commercial forest products and mast for wildlife. These methods, in turn, can affect other resource values, such as vegetation diversity, wildlife habitat, and visual quality. Silvicultural systems and harvest methods are described in the *Timber Supply* section of this chapter.

Since 1986, vegetation management has broadened to encompass more than timber production and wildlife habitat needs. Maintaining or enhancing biological diversity, controlling or eradicating non-native invasive species, and a better understanding of disturbance regimes are now important components of a more ecological approach to managing vegetation. Non-native plants, insects, and pathogens have become more common and widespread since the 1986 Plan was developed. These newly added components in the forest can have substantial impacts on a range of resources by reducing native plant diversity and wildlife forage and changing soil structure. Mortality due to an aging forest and outbreaks by native and non-native insects and diseases is increasing fire hazard. Direction to address these issues was developed for the revised 2006 Forest Plan.

A good distribution of age or size classes across the landscape indicates long-term sustainability and improved forest health. Expectations to move toward a more balanced age or size class distribution were not fully achieved in the last planning cycle. Goals and objectives need to be adjusted in this planning cycle to help ensure that the desired composition and structure of forest vegetation, in those Management Prescriptions that allow active management, can be sustained into the future. Through Forest Plan revision, long-term desired conditions for age classes have been identified for those MPs where vegetation management is emphasized. Vegetation management in areas that allow such activities, combined with natural disturbances in areas of unmanaged forest, will help achieve these desired conditions. There is an opportunity in the revised 2006 Forest Plan to identify the desired species composition and age classes of forest vegetation communities and the distribution of these communities across the landscape.

Regeneration of oaks has been an issue for many years. Fire has been recognized as a major factor in the success of oak regeneration, and most oak species found on the Forest are considered fire adapted. With buds just under the soil surface that allow the seedling to sprout back after top-kill from a fire, oak seedlings are adapted to periodic surface fires. Oaks also have a growth strategy where energy is concentrated on developing a root system instead of increased shoot growth. Maples, a major competitor with oaks in our forests, put more energy into top growth and are unable to quickly recover from top-kill from a surface fire. Plan revision presents an opportunity to expand the potential for using prescribed fire in appropriate areas to:

- Maintain or improve vegetation diversity and to restore vegetation types that depend on or benefit from the use of fire.
- Decrease fuel loading in selected areas to reduce the potential for stand-replacing wildfires and improve forest health.

Issues and Indicators

Issue Statement for Issue #1

Forest Plan management strategies may affect the potential for vegetation diversity and sustainability across the Forest.

Background to Issue #1

The Forest Service is responsible for providing a diversity of plant and animal communities and tree species while providing for the overall multiple-use objectives of national forests (36 CFR 219.26). The Forest Service is also responsible for ensuring a sustainable flow of forest products (Multiple-Use Sustained Yield Act).

An estimated 70 to 80 percent of the Forest is currently the same approximate age (70-100 years) with similar stand conditions. Conversely, there are relatively few forest stands in younger age conditions. The effects of an aging forest include: 1) an increasing susceptibility to forest decline and mortality from insect and disease outbreaks; 2) a decrease in timber and mast productivity and wildlife habitat diversity; 3) an increase in shade-tolerant tree species; and 4) an increase in fuel loads from both down and standing dead trees that may result in a higher potential of more severe fires during periods of extended or extreme drought.

A mix of age classes across the Forest is more conducive to long-term sustainability and diversity to provide a variety of habitats and products in perpetuity. Forest management can affect the mix of age classes or successional stages by implementing regeneration harvests in those Management Prescriptions that allow or emphasize vegetation management. The amount and distribution of these Management Prescriptions vary by alternative, and therefore can be used as an indicator for potential even-aged regeneration harvests and successional stage changes by alternative.

Creating variety in the age class structure in forested stands across the landscape through use of even-aged regeneration harvesting, as opposed to greater variety in age class structure within a stand as a result of uneven-aged stand management, creates diversity that helps lessen the effects of aging and decaying forests. Increases in tree mortality, insects, disease, and shade-tolerant tree species are all part of the aging of a forest and are not inherently negative. However, the concern is that a very large percentage of the Forest will be going through these changes at the same time. Providing for diversity in age classes is one way to reduce the impacts of these changes across the landscape so that mast and timber production, regeneration of shade-intolerant species, and habitat variety are better sustained at the landscape level.

Indicator For Issue #1

Age Class Distribution by Alternative - This indicator will display the potential relative change in age classes under each alternative based on anticipated levels of management activities for Management Prescriptions that allow or emphasize vegetation management. Age class distribution effects will be discussed in terms of potential impacts on forest health, sustainability, and diversity.

Issue Statement for Issue #2

Forest Plan management strategies may affect the potential for vegetation restoration in oak and spruce communities on the Forest.

Background to Issue #2

Species composition is best illustrated using forest types. A forest type indicates the dominant tree species or group of species present but does not always reflect all of the species present in a forested stand. Usually numerous other tree species are also present with the tree species that define a forest type, but in fewer numbers. On the MNF, plant species common to northern climates intermingle with plant species common to southern climates. This results in stands with a great number of species and species mixes. Over 40 commercial tree species occur on the Forest, and it is not uncommon to find 10 to 15 commercial species growing in a 10-acre stand. This high level of diversity is due to the unique geographic, climatic, and topographic features of this area. The intensive land use that occurred mostly in the late 1800s and early 1900s combined with management activities over the past 85 years created the present forest. Despite the intensive use, this resilient forest has grown to be considered a special place among the many people who visit, live, and work here.

More than 95 percent of National Forest System (NFS) land within the MNF is forested and includes at least 36 forest types, representing over 70 tree and associated shrub species. Under natural conditions, a single species seldom exceeds 70 percent of the stocking except in very small areas. Generally, a single-species forest type name will indicate that one species represents a plurality of the total stocking. In a multiple-species forest type, two or more species will represent a plurality of the total stocking.

Over time the forest type within a stand may change as some tree species that are short-lived (e.g., scarlet oak) succumb to natural mortality while longer-lived tree species, such as white oak, survive and become more prevalent within a stand. Other modifications may result from high mortality rates of specific species due to insects and disease, such as hemlock wooly adelgid or beech bark disease. Forest type modifications over time may result in altering wildlife habitat, scenic quality, forest product availability, and recreation opportunities.

Oak communities in particular are currently in decline due to changes in stand density, structure, and composition leading to a decreasing trend in vegetation diversity. In areas where fires helped perpetuate oak and oak-hickory forests, decades of fire suppression have created conditions where oak species are not competing well with species such as striped and red maple and American beech. Light conditions in the mid-story are not suitable for oaks to regenerate. Timber harvest and prescribed fire can be used to mimic the effects of historic fire regimes in areas where these activities are both allowed by Forest Plan direction and are considered ecologically appropriate.

Although red spruce has been slowly expanding its range over the past few decades, red spruce and spruce-hardwoods mixed forests once covered much more area than they do today (see the *Terrestrial Ecosystem Diversity* section for detailed description and estimates of pre-settlement extent of red spruce forests). While opportunities for active restoration of the red spruce community are limited in areas determined to be suitable habitat for the West Virginia northern flying squirrel, there are areas where red spruce and mixed red spruce-hardwood forests could be actively managed to increase red spruce dominance.

The oak and red spruce communities represent the ends of the spectrum of diversity on the Forest. Red spruce dominates at higher elevations, under cool moist conditions, while oak communities flourish under drier, warmer conditions at lower elevations. Fire was historically a frequent visitor to oak communities, usually about every 7 to 32 years in a given area, however the fires were typically low intensity, mainly affecting the ground surface. In red spruce communities fire is not the driving disturbance regime, as it may have only replaced stands every 300 to 1,000 years. However, when fire occurred in spruce stands it was most likely of high intensity, resulting in stand replacement.

There are social and economic consequences for all land management decisions on MNF land. Those effects will be examined in the social and economic impact analysis for this EIS. The vegetation analysis will focus on the potential biological effects from management prescribed under each of the alternatives, and how that management may affect the diversity, sustainability, and general health of forest communities within the MNF.

Indicators For Issue #2

1) **Acres of potential change in restoration of oak and spruce communities by alternative** - This indicator is a coarse measure of how each alternative addresses the issue of potential change through restoration activities in oak and spruce communities on the Forest. Lands suitable for timber harvest in MPs 2.0, 3.0, 4.0, 4.1 and 6.1 represent the areas most likely to be actively managed. Oak restoration will mainly occur in MP 6.1, although other MPs that allow restoration management activities may also be considered. Most of the spruce restoration assigned to MP 4.1 is designed for passive management. For most of MP 4.1 and for MPs that do not allow active management, the forest communities will continue to age naturally.

2) **Acres of Fire Regime I Condition Class 3 and Fire Regime III Condition Class 2 in MPs 3.0, 6.1, and 8.1 by Alternative** - These Fire Regime Condition Class (FRCC) areas are the areas of highest priority for returning fire to the ecosystem. These areas are at highest risk of losing key ecosystem components, namely the perpetuation of oak forests. Because prescribed fire may be used at the landscape scale and not necessarily tied to a commercial timber sale, both suitable and unsuitable lands are included in the indicator.

Scope of the Analysis

The affected area for direct and indirect effects to Issue #1 are lands administered by the MNF. This area represents lands that would be actively managed on the Forest. Effects will be assessed for the first, fifth, and tenth decades of plan implementation to show how age class diversity would change over time. The affected area for direct and indirect effects to Issue #2 are NFS lands available for oak and spruce restoration activities under each alternative. Effects will be discussed for both the short (up to ten years) and long (up to 100 years) terms. The affected area for cumulative effects on vegetation is generally the forested lands in the counties that have NFS lands located within them. The State of West Virginia will also be used to provide context for some indicators. Effects will be discussed for both the short and long term.

CURRENT CONDITIONS

Age Class Diversity

Age class distribution can be defined by delineating age categories into successional stages that are found in forested stands. This analysis will compare changes in age class distribution from the current conditions by alternative. As used in the Forest Plan and EIS, successional stages include structural changes in plant communities as well as species compositional changes. Traditional successional stages describe just the changes in species composition that occur as forests age, and structural changes are described as forest development stages. The age classes described here incorporate both. As the forest ages, there are structural changes such as canopy closure, self-thinning, suppression of understory vegetation, death of overstory trees, and re-initiation of the understory. In general, there is also an increase in shade-tolerant species in the understory and a decrease in early successional plants such as black locust and blackberries. All these changes can vary by site factors such as elevation, slope, aspect, soil, and past management.

The amount and distribution of age classes or successional stages will result in variations of biological diversity from young forests to old forests, with potential impacts on wildlife habitat, biological diversity, scenic quality, types of forest products, and recreation opportunities. Most stands on the MNF are even-aged, meaning there is a relatively small difference in ages of the majority of trees within individual stands of trees. When age classes are more evenly distributed across the Forest, it is indicative of a long-term sustained yield capability to provide a variety of habitats and products in perpetuity. For analysis purposes, the age/forest succession stages to be used are shown in Table VE-1.

Table VE-1: Age Class and Corresponding Forest Succession Categories

Age	Stage
0-19 years	early succession
20-39 years	early to mid-succession
40-79 years	mid-succession
80-119 years	mid to late succession
$\geq$ 120 years	late succession

Generally, commercial timber harvest has been the means by which the Forest manages age class distribution on lands available and suitable for commercial timber management. The 1986 Forest Plan determined there were an estimated 534,322 acres that were tentatively suitable for timber harvest. However, there were constraints on vegetation management in the 1986 Plan (e.g., WVNFS habitat and stream channel buffers) that were not considered during the determination for timber suitability. Specifically, many acres that were not truly available for regulated commercial harvest were not deducted from the suitable timber base. Counting those additional constraints, the 1986 Plan actually allowed for commercial timber management on about 331,000 acres. The remaining acres on the Forest were expected to change primarily through natural events and succession. On an estimated 23 percent of the Forest (5.0 Wilderness and 6.2 Backcountry Recreation MPs), natural forces were the only disturbance factors expected to affect forest type and age class diversity.

The large majority of stands on the MNF (92 percent) are over 40 years old. About 3 percent of MNF land is in young forested stands less than 20 years old. This indicates the age classes are currently not well distributed. A better distribution would ensure a sustainable supply of mast and forest products (e.g. 15% of acres in 0-19 year age class, 15% of acres in 20-39 year age class, 30% of acres in 40-79 year age class, etc.). With the existing poor distribution of age classes, the forest would continue to age beyond maturity, gradually declining in timber and mast production capability, and becoming more susceptible to insect and disease outbreaks and other age-related problems.

Table VE-2 shows the current age class distribution on the MNF by forest type. The "no-age" category represents areas that have not been classified in the database inventory.

Table VE-2 – Current Age Classes by Forest Type on the MNF

Forest Type	Age Class												Grand Total	
	0-19		20-39		40-79		80-120		>120		No Age			
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Eastern Spruce-Fir/Pine	2,497	7	3,363	9	18,460	50	10,507	29	1,430	4	550	1	36,807	4
Eastern White Pine-Eastern Hemlock	171	3	526	8	3,250	50	2,248	34	191	3	165	2	6,551	1
Pine-Oak	698	1	3,359	8	12,745	29	24,173	55	2,796	6	342	1	44,113	5
Mixed Oak (Oak–Hickory)	8,097	3	8,389	4	54,662	24	139,674	60	18,947	8	1,613	1	231,382	26
Bottomland Hardwoods	0	0	28	4	224	27	568	69	0	0	0	0	820	<1
Appalachian Mixed Hardwoods	11,201	3	17,139	5	129,048	36	196,392	54	5,732	2	1,129	<1	360,641	41
Northern Hardwoods	3,747	2	5,672	3	75,843	39	103,104	52	7,692	4	759	<1	196,817	22
Totals	**26,411**	**3**	**38,476**	**4**	**294,232**	**34**	**476,666**	**54**	**36,788**	**4**	**4,558**	**<1**	**877,131**	**100**

Forest Insects And Diseases

Pre-settlement patterns of insect/disease outbreaks are unknown but were probably cyclical with stand replacement events occurring rarely at unpredictable intervals. Post-settlement insect or disease outbreaks most likely have increased in quantity and intensity because of the introduction of non-native insects and diseases. Management strategies to control severe outbreaks of insects and diseases should include all landowners in the outbreak area. Passive or non-management of insect and disease outbreaks by one landowner can have negative impacts on adjacent landowners or re-infestation of lands that have implemented control measures.

Native Insects and Diseases

Native insects and diseases are important components of a "natural" forest ecosystem. A "healthy" amount of native insects and diseases have many beneficial effects that include helping to decompose woody vegetation, contributing to diversity, enhancing habitat for plants and animals, and assisting the ecological succession of the forest. However, large outbreaks of native insects and diseases can have negative impacts such as reducing tree growth or value, causing large-scale tree die-back or mortality, decreasing water quality, increasing fire risk, creating safety hazards, diminishing scenic views, and reducing biodiversity. Examples of a native disease and insect pest are described below.

Oak Wilt – This disease that affects oak growth and can cause tree mortality was first discovered in 1942 in Wisconsin and in 1951 in West Virginia. It is now known to be present in all counties in West Virginia except Webster, Tucker, Brooke, and Ohio. In 2002, surveys of the four high disease infection centers in the state found 20 sites with oak wilt; 17 were located in Grant County and 3 in Hardy County (http://www.wvforestry.com/indassistance.cfm?menucall =industry). Oak wilt is a vascular disease caused by the fungus *Ceratocystis fagacearum*. The disease can be spread to healthy trees by sap-feeding beetles. Adjacent trees can be infested through root grafts. Trees in the red oak group are most susceptible to this disease, although trees in the white oak group may also be affected on occasion. The most effective control method appears to be removing the infected trees and susceptible adjacent trees. The roots should be severed by digging trenches around the infested trees to prevent the disease from spreading via root grafts. Injection of individual high-value trees with a fungicide is an alternative treatment but is cost prohibitive in a forest setting (USDA Forest Service 2002b).

Forest Tent Caterpillar (*Malacosoma disstria*) - This native insect is a defoliator and affects mostly sugar maple, blackgum, and several oak species throughout most of the United States and Canada. Significant tree mortality is rare unless trees are defoliated for 3 or more successive growing seasons, but dieback and loss of growth can be substantial. The caterpillar can be a major nuisance in recreation areas as they migrate from tree to tree, and defoliated trees cause negative visual impacts to Forest visitors. Native predators, insects, fungi, and viruses are natural controls. Extreme temperatures (hot or cold) also help to control this insect. There are several registered chemicals available to assist in control.

Non-native Invasive Insects and Diseases

Non-native invasive species (NNIS) have the potential to reduce native plant diversity and disrupt entire ecosystems. NNIS are plants, insects, animals, or diseases that come from countries or continents outside of North America. Many non-native species are harmless or beneficial, such as many of the grains and fruits now grown in the United States. However, some non-native species have the potential to become invasive because the natural control agents that kept them from spreading uncontrollably in their native habitat are not present here. NNIS plants have their own section in this chapter. This discussion will focus on non-native invasive insects and diseases that can affect vegetation management on the Forest.

Some of the more well-known NNIS insects and diseases present on the MNF include gypsy moth, hemlock wooly adelgid, beech scale, chestnut blight, Dutch elm disease, butternut canker, and dogwood anthracnose. There is potential for other NNIS insects and diseases, present in other nearby states, to spread to West Virginia. The Asian long-horned beetle has so far been contained to New York, New Jersey, and Illinois. The impact of this insect could be devastating to native forests if it escapes from these areas because it may affect many species of hardwood trees. The emerald ash borer attacks all species of ash trees and has been found in Michigan, Ohio, Indiana, Virginia, and Maryland. Sudden oak death is caused by a fungus that had been contained to California until 2004 when plants from infected nurseries were shipped to numerous states in the Eastern United States. This fungus has killed millions of oak trees in California.

Described below are some of the non-native insects and diseases present on the MNF and that could have potential major effects to tree vegetation on the Forest.

Gypsy Moth (*Lymantria dispar L.*) – This insect was introduced, from France to the United States in 1869. The first defoliation outbreak occurred in 1889 (McManus, Schneeberger, Reardon and Mason 1989). Oak trees (especially white and chestnut oak) are the preferred host. Pine-oak and mixed oak forest types are most susceptible to this non-native pest, but the mixed hardwood and northern hardwood types may also be affected in severe outbreaks.

In the late 1980s and early 1990s, gypsy moth caterpillars were defoliating thousands of acres in the north and east sections of the MNF. A population crash in 1993, caused by a virus specific to gypsy moth and the fungus *Entomophaga maimaiga*, kept this insect under control for several years. High humidity, frequent periods of rain, and fairly constant temperatures between 14°C to 26°C are needed for the fungus to germinate and spread (Reardon and Hajek 1998). An increase in the number of gypsy moth egg masses on the Forest in 2000 resulted in a population build-up, causing defoliation in numerous hot spots in the eastern side of the MNF. The population increase was due to dry spring weather for the previous two years. A continued increase in the population with successive years of defoliation may cause extensive tree mortality. Several areas on MNF land were sprayed with *Bacillus thuringiensis,* a pesticide specific to insect larvae in the Lepidoptera family (moths and butterflies) in 2001. The spraying, accompanied by wet weather in June of that year, allowed the fungus to become active, causing another population crash. An egg mass survey in the late summer/early fall of 2001 revealed a severe drop in the number of egg masses. Populations began building again in 2002, resulting in spraying several hot spots on the east side of the Forest in the spring of 2003. A pesticide spray program for gypsy moth did not occur on MNF land in 2004, and there are no plans to spray in 2005.

Hemlock Wooly Adelgid (*Adelges tsugae)* - This sapsucking insect, introduced to the United States from Asia in 1924, was detected in Grant and Pendleton Counties in 1992 and in Pocahontas County in 1993 (Hutchinson 1995). The insect feeds on twigs, causing the foliage to discolor and drop prematurely. Defoliation and death usually occurs about 4 to 10 years after a tree is infested. Eastern hemlocks are highly susceptible to this insect and no resistant trees have been located to date. However, several common and introduced predators of the adelgid, including *Laricobius* and *Pseudoscymnus* beetles, have been released and may prove to be an effective control (McClure, Salom, and Shields 2003; Kajawski 1998; Montgomery and Lyon 1996). Some of the predatory beetles have been released in the MNF and nearby state lands. Severe cold weather also seems to control this pest. In the winter of 1993-1994 severe cold weather (-20° to -28°F) greatly reduced populations (Souto, Luther, and Chianese 1995). Chemical control can be used in easy access areas within or near developed recreation sites or high-quality scenic areas. However, this is very costly, and repeated treatments are needed to control the pest.

Beech Bark Disease - The beech scale insect (*Cryptococcus fasigua*), native to Europe, arrived in Nova Scotia around 1890. By 1932 trees in Maine were dying from its infestation. The disease results when the bark is attacked by the beech scale, then invaded by fungi, primarily *Nectria coccinea* var. *faginata* and *N. galligena,* which eventually kill or severely injure beech (Houston and O'Brien 1983). Beech trees over 8 inches in diameter are more severely affected then smaller trees. Mortality occurs in about 30 percent of the trees that are infected. Over 90 percent of the remaining beech trees in a stand become severely injured and do not produce quality wood (Leak and Smith 1996). Once the stem of a beech tree becomes severely affected or dies, the roots grow sucker sprouts and can form dense thickets. These sucker sprouts are also susceptible to the disease but may live for many years. The dense regeneration of beech within the infested stands prevents the regeneration of other hardwood or conifer trees. As a result, the productivity of the stands decline as the disease progresses, decreasing stand health. Removing infected and high risk trees provides an opportunity to salvage some of the material and improve the health and diversity of the stand (Ostrofsky and Houston 1988). A recent study indicates the timing, harvest method, and treatment type of a cut may influence the root sprouting and the overall health of an infected beech stand. Cutting diseased trees in the summer or fall reduced sprouting. In clearcuts, leaving scattered unaffected beech trees increased sprouting of the healthy stems (Houston 2001).

Chestnut Blight (*Cryphonectria parasitica*) - This fungus was probably introduced through the importation of chestnut trees from Asia, and was first reported in the United States in 1904. Within 50 years the fungus occupied the tree's entire range and had killed 80 percent of the American chestnut (Kuhlman 1978). Nearly all the remaining live trees were infected with the fungus and dying. Prior to the infestation, the American chestnut was a major component of the eastern hardwood forest, comprising 25 percent of all tree species on over 200 million acres from New England to Georgia (MacDonald et al. 1978, Schlarbaum 1989). This tree, which once grew up to 120 feet tall and over 7 feet in diameter, now rarely attains heights over 30 feet with diameters up to 6 inches before the fungus kills the stem. The process starts over when the tree resprouts. A few resistant trees have been found. There is hope that some time in the future the American chestnut will return as a valuable timber and wildlife tree to the eastern hardwood forest (Newhouse 1990). The American Chestnut Foundation is working with researchers to develop blight resistant American chestnut trees.

Forest Community Restoration

With new knowledge of the role that repeated surface fires play in regenerating oaks, the Forest has re-defined the 6.1 Management Prescription to emphasize the restoration and maintenance of oak and oak-hickory forest communities. Coupled with the concern for regenerating oaks forests is the concern for creating diversity in age classes across the landscape. Mast production is generally abundant across the Forest most years; however with most stands the same age, age-related declines in mast production will likely cause large drops in mast at about the same time. Therefore, MP 6.1 also stresses the need for even-aged regeneration harvest to ensure stable mast supplies over the long term across the landscape.

Red spruce communities once covered much more of the Forest than they do now, and the Forest includes the highest elevations in the State that comprised much of this community. Habitat for the federally endangered West Virginia flying squirrel is found in this community and forms the core of MP 4.1. Additional areas were assigned this MP if determined, at a coarse scale, to be ecologically suited to red spruce or red spruce-hardwood forests. The creation of this MP represents a move away from single-species management (focus on WVNFS habitat) to a community or ecosystem approach that acknowledges both passive and active management in restoration and maintenance of this community.

The Oak Regeneration Problem

Acknowledgement of an oak regeneration problem has slowly grown through the years as the idea that abundant and widely distributed oak forests were considered self-perpetuating climax species on upland sites was challenged by reports of poor competition. Evidence began building that, while oak seedlings were found in the understory, other species were as well and competed better than the oaks. Weitzman and Trimble (1957) found that only 18 percent of the seedlings on good sites (site index 70) were oak species, and oaks comprised only 3 percent of the seedlings on excellent sites (site index 80). Oak seedlings do not live long under a canopy on good sites, often only persisting a few years, and young seedlings seldom respond to release. While competition from other species is a cause of oak regeneration failures, failures are not occurring because other species are so aggressive but because oaks are often poor competitors (Lorimer 1989).

The oak regeneration problem is not unique to the Monongahela National Forest, and is occurring in many areas where oaks dominate the landscape. Because the species and the regeneration problems span a wide geographic scope, a solution to the problem is likely similar in scope. The large scope of the problem led researchers and managers to explore the role of fire in the ecology of oaks and oak-dominated forests. Oak seedlings are able to sprout back rapidly after top-kill from fire, and large older oaks generally have thick bark that insulates them from damage from surface fires.

Oaks are not easily classified in the classic climax theory of succession. Unlike most early successional (pioneer) species dependant on disturbances, oak seedlings can be found under closed canopies but are usually slow growing and uncompetitive even under open conditions. However, oaks can form stable communities on dry sites where shade-tolerant competitors are sparse. Oaks can invade moist sites after severe disturbance (such as after the turn of the 20th century logging), but perpetuation of the community seems to depend on fire.

Published proceedings of two symposia on oak ecology and regeneration problems represent the state-of-the science on oak regeneration issues (Loftis and McGee 1993, Spetich 2004). While fire is recognized as needed to perpetuate oaks on many sites, one burn is not enough, and often makes the situation worse for oak seedling competition. Repeated surface fire is needed (Van Lear and Waldrop 1989, Van Lear 1991, Keyser et al. 1996, Brose et al. 2001).

The mixed oak types are considered to be in Fire Regime Group I with a fire return interval of 7 to 32 years (Croy and Frost 2005). Most fires were contained at the surface level except in drought periods when higher intensity fires would create patches of openings in the canopy. Frequent surface fires prevent the mixed oak types from succeeding to mixed hardwood types. Effective fire suppression allows shade-tolerant, fire-sensitive species such as red maple and American beech to invade the mixed oaks and inhibit oak regeneration.

Prescribed Fire

The 1986 Plan allows for prescribed fire to establish, maintain, or control vegetation in some Management Prescriptions but does not discuss restoration needs. The 1986 Plan also briefly mentions managing activity fuels and discusses the need for fuel breaks, but fire regime condition classes are not mentioned. The Forest-wide standards and guidelines describe only prevention, detection, suppression, investigation, and rehabilitation needs. The Healthy Forests Restoration Act (HFRA) of 2002 promotes fire as a tool to maintain or restore healthy forest ecosystems. The revised 2006 Forest Plan also recognizes that prescribed fire can be an important tool for restoration, especially in fire-adapted ecosystems. Indeed, the 2006 Plan has a Forest-wide objective to:

> Over the next 10 years use prescribed fire on 10,000 to 30,000 acres. Emphasize use in areas to maintain, restore, or enhance wildlife habitat or other ecosystem components and/or reduce hazardous fuels and fire risk to property or investments.

The areas where this prescribed fire is most likely to occur are Fire Regime I, Condition Class 3, and Fire Regime III, Condition Class 2 in Management Prescription 6.1 because these areas are the most in need of ecosystem restoration and fuels reduction.

Over the past 20 years the MNF has averaged 8 wildfires per year, burning on the average 106 acres per year. Most of these fires are human-caused (92 percent) and 70 percent burned at a low-intensity level. In the preparation of the 1986 Forest Plan, the use of fire by the indigenous people and early European colonists was not clearly understood or recognized. Recent archeological studies found humans in the southern Appalachians have used fire selectively for at least 4,000 years (Delcourt and Delcourt 1997).

The MNF began using prescribed fire as a management tool in 1998, burning 85 acres. In 2003 the MNF burned 221 acres. The need for using prescribed fire as a management tool in this planning cycle is becoming more apparent as declining populations of mixed oak/hickory forests and other fire-adapted tree species are reducing the diversity of the forest vegetation ecosystems.

Successful fire prevention and suppression efforts have led to a decrease in fire-adapted species. The mixed oak/hickory forest types—as well as other less abundant tree species such as aspen, pitch pine, and table mountain pine—are declining. Oaks and hickories provide a valuable wildlife food source. Other tree species that are not as valuable a food source for wildlife—such as red maple, American basswood, sugar maple, and striped maple—are increasing in the forest understory due to the lack or absence of low-intensity wildfires. Ladder fuels—such as white pine saplings and poles, mountain laurel, and rhododendron—are also increasing in the forest understory.

A fire regime is a generalized description of the role of fire within an ecosystem characterized by fire frequency, predictability, seasonality, intensity, duration, and scale. The departure of current conditions from the natural historical frequency and severity of fires is identified as the fire condition class. Table VE-3 describes and categorizes the historic fire frequency and severity. Table VE-4 describes and categorizes the current vegetation composition and structure conditions and serves as rankings of severity risk.

Table VE-3 – Historic Natural Fire Regimes

Fire Regime Group	Fire Frequency (years)*	Fire Severity**
I	0-35	Low severity; surface fires with little to no mortality of upper canopy
II	0-35	Stand replacement severity; crown fires with high tree morality
III	35-100+	Mixed severity; surface fires with some mortality of upper canopy
IV	35-100+	Stand replacement severity; crown fires with high tree morality
V	>200	Stand replacement severity; crown fires with high tree morality

*Fire frequency is the average number of years between fires (return interval).
**Fire severity is the effect of the fire on the dominant overstory vegetation.

The current condition class is a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural change of vegetation, stand age, and canopy closure. This change may have been caused by one or a combination of activities or lack of activities such as timber harvesting, fire suppression, grazing, establishment of non-native invasive species, and/or insect or disease outbreaks. The result of the change is a potential increase or decrease in fire frequency, intensity, severity, or size.

Table VE-4 – Condition Class Descriptions

Condition Class	Fire Regime
1	Vegetation composition and structure are within historical range – risk of losing key ecosystem components is low.
2	Vegetation composition and structure are moderately altered from historical range due to an increase or decrease of historical fire frequency by one or more return intervals – risk of losing key ecosystem components is moderate.
3	Vegetation composition and structure are significantly altered from historical range due to an increase or decrease of historical fire frequency by multiple return intervals – risk of losing key ecosystem components is high.

About 118,000 of the MNF acres are in Fire Regime Group I (pine-oak and mixed oak forest types) and in Fire Regime Condition Class 3, which is defined as being at high risk for losing key ecosystem components due to a decrease in historic fire frequency. The historic natural fire regime for these drier sites indicates a fire frequency interval of 0-35 years for low severity fires. On an estimated 175,600 acres, the historic natural fire regime is 35-100+ years with mixed severity fire intensity levels; these areas are considered in Condition Class 2. These estimations are the result of a first rough look at the fire regime condition classes on the MNF and are subject to revision. Approximately 253,000 of these acres are located within Management Prescriptions (MPs) 2.0, 3.0, 6.1, and 8.0 that allow for prescribed fire in their standards and guidelines in the 1986 Forest Plan. Over 1,000 acres are in MP 7.0 that allows only for fuel management, and over 45,000 acres are in MPs 5.0 (5,200 acres) and 6.2 (40,000 acres) that do not allow for the use of prescribed fire. The remaining acres are in areas that presently do not have an MP assigned. An additional 6,000 acres that were recently acquired will most likely be added to Fire regime I, Condition Class 3, as the acres are located in the mixed oak and oak/pine forest types on the dry (east) side of the MNF.

Fire occurrence on the east (drier) side of the MNF was fairly common, except within the past 40 years. It has recently been documented that fires occurred here every 7 to 32 years. (Schuler and McClain 2003). The west (wetter) side of the MNF likely had substantial wildfires only during the driest years. Successful fire prevention and suppression efforts have greatly decreased the number and size of fires over the past 40 years. These efforts have increased fuel loading by allowing woody material to build up on the forest floor in the absence of fire. The number of standing dead trees will continue to add to the fuel load as the forest ages and mortality increases. A decrease in the amount of timber harvested has also contributed to the fuel load since many high-risk, damaged, or diseased trees that would have been removed in a timber sale were left to die, leaving standing snags and other dead trees to rot on the ground. Other factors contributing to an increase in fuel loading are an additional number of dead/dying trees from non-native pests such as beech bark scale/nectria complex disease, hemlock wooly adelgid, and gypsy moth. Ice and wind storms continue to contribute to fuel loading. Prescribed fire can be used to improve forest health by:

- Restoring the composition, structure, and functions of fire-adapted forest communities,
- Reducing accumulating fuel loads, thereby decreasing the potential risk of high-intensity wildfires and damage to resources and property.

The potential for high-intensity wildfires is increasing in some areas because of the accumulating fuel loads resulting from an aging forest that is also affected by mortality from non-native insects and diseases. This is compounded by the fact that a once rural area is now becoming increasingly populated, creating high-risk urban wildland interface situations. Numerous small development projects have constructed homes in areas that once were contiguous forests. These new homes are usually constructed in small openings surrounded by forest. Many of these developments are accessed on small, dead-end, one-lane graveled roads, and some homes may be several miles from a main highway. Of the 167 communities located in the vicinity of federal lands in West Virginia that are listed at high risk from wildfire (Federal Register 2001), around 90 are located either inside the MNF proclamation boundary or are within 5 miles of the boundary. Prescribed fire is needed to reduce the risk of high-intensity wildfires that have the potential to damage or destroy homes and communities.

Although woody material on the forest floor generally increases as the forest ages, the discussion on the increase in fuel loads is not currently applicable to fire probability and intensity on the entire Forest. On most of the Forest, climate and landform would likely continue to influence fire behavior such that large natural fires would be rare and prescribed fire would be difficult to implement due to generally wet conditions. However, wet conditions can dry out in extended or extreme drought, which has occurred in the past and could occur in the future. In the short term, though, our best opportunities for implementing prescribed fire and fuel reduction are in areas where fire is a more frequent part of the disturbance history – those areas considered to be in Fire Regimes I and III, about 118,000 acres as described earlier in this section.

Spruce Restoration

Vegetation management in the spruce-fir forest type over the next planning period will focus primarily on a passive strategy in WVNFS suitable habitat. The constraints from the 2004 Forest Plan Amendment on Threatened and Endangered Species allow primarily for research projects and administrative studies in areas considered suitable for WVNFS. However, active management (thinning to release established spruce trees, reforestation) in northern hardwood stands with a spruce component can be designed to help increase this component over time.

Since red spruce is shade tolerant, the recommended regeneration harvest methods most acceptable are in the uneven-aged silvicultural system. The two-aged, shelterwood, and seed-tree methods are not recommended because red spruce is so shallow-rooted that the residual trees tend to blow down before regeneration is established.

Both harvest methods of the uneven-aged system may be used to secure regeneration and are particularly applicable where scenic values, recreational use, and wildlife that are dependent on a healthy, continuous forest cover are of concern. Care must be taken on exposed areas not to open up the stand heavily enough to risk wind throw of the residual trees.

Forest Types and Vegetation Diversity

For the purpose of this analysis on vegetation, forest types will be used to discuss species composition, diversity, potential effects of NNIS, and maintenance or restoration of forest health. The amount of each forest type under each alternative will be compared to the existing condition and may change by alternative depending on the amount of activity allowed under each Management Prescription.

Eastern Spruce-Fir Type (including red pine) - A large portion of the red spruce forest community in the central Appalachians is located in West Virginia on the MNF. It has been estimated that red spruce originally occupied almost 470,000 acres in the mountains of northern and eastern West Virginia at elevations generally above 3,200 feet. The eastern spruce-fir type on the MNF represents about 4 percent of the forested area and consists mostly of red spruce although there are some small, scattered areas of balsam fir and plantations of Norway spruce and red pine. An estimated 83 percent of the acres in this forest type are in the mid to late successional stages, and 7 percent in stands less than 20 years old. Norway spruce and red pine were planted, in place of red spruce, due to the better survival rates and faster growth of these species. One small area also includes some Fraser fir that was artificially seeded in the 1930s. In the spruce areas, the climate is cool and humid, with annual precipitation in the neighborhood of 60 inches.

The intense fires that followed the clearcutting around the turn of the 20th century drastically reduced the amount of red spruce. Because the wildfires that reduced the acreage of spruce also reduced the depth of organic soil in which most of the spruce formerly grew, site quality was also reduced. The eastern spruce-fir type is considered to be in Fire Regime Group V where fire disturbance is rare (300 to 1,000 year return intervals) but severe (Gorman 2005). Large amounts of fuel buildup that would occur during that time period, combined with typical dense stands of spruce/fir type, increase the likelihood of rapidly spreading crown fires of stand-replacement intensity. Fires would occur only during periods of severe drought. Other disturbances from ice storms, wind throw, and insect attacks occurred more frequently (100-200 year return intervals).

The relatively small acreage of spruce in pure or nearly pure stands generally occupies areas of shallow rocky soils where site quality is fair to poor. Most of the spruce found on better sites occurs as scattered groups or as individual trees in northern hardwood ecosystems. By definition, the eastern spruce-fir type is comprised of stands with a plurality of spruce and/or fir. In many situations this type also includes stands composed of a large percentage of hardwood stems and can be considered a spruce-hardwood complex.

Red spruce grows in association with hemlock, red and sugar maple, yellow birch, pin cherry, beech, and black cherry, but it may grow in almost pure stands. Mosses, lichens, and club-mosses with occasional wood sorrel, trillium, and teaberry plants usually dominate the understory beneath closed stands of spruce. In openings and along edges or beneath open mature stands, rhododendron, mountain ash, and wild raisin are key shrubs. They may be associated with high-bush cranberry, mountain holly, mountain laurel, speckled alder, pin cherry, serviceberry, brambles, blueberries, and huckleberries. Where the type intergrades with northern hardwoods, the understory is usually better developed.

Habitat for the federally endangered West Virginia northern flying squirrel (WVNFS) is found in this community and forms the core of MP 4.1. For the purpose of the vegetation analysis, red pine is included in this forest type because of the potential for WVNFS to use this habitat when in proximity to red spruce. Because of this potential to be included as suitable WVNFS habitat, it is unlikely active management will occur in red pine stands adjacent to red spruce stands during this entry. Additional areas were assigned this MP if determined, at a coarse scale, to be ecologically suited to red spruce or red spruce-hardwood forests. The creation of this MP represents a move away from single-species management (focus on WVNFS habitat) to a community or ecosystem approach that acknowledges both passive and active approaches to restoration and maintenance of this community.

Other wildlife species found in the eastern spruce-fir ecosystem includes snowshoe hare, wood warblers and other songbirds, rodents, and the federally listed Cheat Mountain salamander. Several game species such as bear, grouse, and deer are adapted to using the edges of mature spruce stands.

Pine-Oak Type - The pine-oak type is usually found on the eastern side of the MNF on dry ridges and generally on south- and west-facing slopes. All of the oak species on the MNF can be found in this type along with pitch pine, Table Mountain pine, and Virginia pine. The pine species are all intolerant of shade while the oak species range from intolerant to moderately tolerant. Most tree species found in this type are either fire dependent or require some level of disturbance to regenerate and grow.

Typically this type includes some of the less productive sites on the Forest due to lack of consistent moisture. The pine-oak type makes up about 5 percent of the vegetation types found on the MNF, with 90 percent in the mid to late successional stages and 1 percent in stands that are less than 20 years old. This type is a transitional stage from a mostly pine type to the oak-hickory type. Without silvicultural treatments associated with timber harvests—such as planting, herbicides, or prescribed fire (if there are no pine seedlings in the understory)—this type will continue to decline.

Tree species associated with this type include most of the hickory species, red maple, blackgum, sourwood, and yellow poplar. Blueberry, huckleberry, blackberry, greenbrier, azaleas, and mountain laurel are commonly found in the understory.

Historic fire return intervals for the pine-oak types are estimated at 3-15 years. The pine-oak types are considered to be in Fire Regime Group I with mostly surface and mosaic pattern (mixed severity) fires occurring at frequent intervals. Usually fires ranged in size from 10 to 50 acres but in dry years would exceed 300 acres (Fryar 2004).

Mixed Oak (Oak-Hickory) Type - Although mixed oak-hickory types occur over the entire Forest at elevations between 1200 and 3000 feet, the oak-dominated stands on good to excellent sites are classed with the Appalachian Mixed Hardwood type discussed elsewhere. Most of the species found in this ecosystem are in the middle range in shade tolerance as exemplified by the oaks and hickories. However, considerable difference exists among species. For example, scarlet oak is relatively intolerant compared to white oak and red maple, while at the extremes, beech is very tolerant and black locust is very intolerant. Red oak is the most demanding oak in terms of site quality and is more abundant on the higher quality sites. Scarlet and chestnut oak are more commonly found at lower quality sites.

The five widely distributed upland oaks in this type are white, northern red, black, scarlet, and chestnut. Although less abundant, the hickories are consistent stand components. This forest type comprises about 25 percent of the forested area on the MNF, with 92 percent in the mid to late successional stages and 3 percent in stands less than 20 years old. Other commonly found associates are blackgum, beech, red maple, sourwood, sassafras, black locust, sweet birch, and pines. This type commonly will have less herbaceous vegetation in the understory but the shrub/vine layer may be very dense. Sassafras is a key shrub or small tree, while some others are flowering dogwood, serviceberry, sumacs, hawthorns, eastern hophornbeam, and redbud. Among the vines and small shrubs, the most common are greenbriers, blueberries, huckleberries, grapes, blackberries, raspberries, mountain laurel, azaleas, roses, and teaberry.

The continued presence of mixed oak forests is primarily related to maintaining or restoring conditions to ensure oak regeneration. Silvicultural treatments that create conditions to promote oak regeneration by reducing competition include prescribed burning and herbicides. Once the oak regeneration has grown to at least 4.5 feet tall, it should be released by a commercial timber harvest or a non-commercial pre-harvest activity to provide full sunlight to encourage growth of the young oak trees. Oak dominance can be maintained by non-commercial crop tree release of young stands, and by moderate fire return intervals in mid and mid-to-late successional stands.

The mixed oak types are considered to be in Fire Regime Group I, with a fire return interval of 7 to 32 years (Croy and Frost 2005). Pre-settlement fires were estimated to occur every 3 to 14 years. Most fires were contained at the surface level except in drought periods when higher-intensity fires would create patches of openings in the canopy. Frequent surface fires deter the mixed oak types from succeeding to mixed hardwood types. Effective fire suppression allows shade-tolerant, fire-sensitive species such as red maple and American beech to invade the mixed oaks and inhibit oak regeneration.

Non-native insects and disease have affected the mixed oak type over the years. In the early 1900s the American chestnut was a dominant tree in this forest type prior to the chestnut blight. Oaks and hickories filled the gaps where the chestnut grew. The gypsy moth is present in West Virginia and has defoliated thousands of acres. The oaks are the favored food source for gypsy moth but other hardwood and conifer species can be defoliated during severe outbreaks. Recently a fungus and a virus that specifically attack the gypsy moth have aided in keeping this non-native insect from spreading more rapidly.

Appalachian Mixed Hardwoods Type - Appalachian mixed hardwoods, commonly called cove hardwoods, is a forest complex found in rich, moist locations and is characterized by great diversity in composition. This type represents about 40 percent of the Forest and is found in topographic coves, on lower slopes with a northern or eastern aspect, and on gentle terrain.

About 92 percent of the acres in this forest type are in the mid to late successional stages with 3 percent of the area in stands less than 20 years old. Stands are characterized by a large number and variety of plant species. Overstory composition may range from nearly pure stands of northern red oak or yellow poplar to typical mixtures of 20 or more commercial species. Among the more important trees are yellow poplar, sugar maple, northern red oak, hickories, black cherry, white oak, basswood, aspen, cucumber tree, white ash, red maple, sweet birch, beech, elm, and black locust. The mixtures vary with site quality, past treatment, elevation, and latitude. Conifer species can include white pine, red spruce, and hemlock.

Among major Appalachian mixed hardwood species, shade tolerance ranges from very tolerant beech, hemlock, basswood, and sugar maple to the intermediately tolerant oaks, hickories, birches, and white ash to intolerant black cherry, black locust, and yellow poplar. Most intolerants and some intermediates will not survive long under a dense canopy. Sugar maple and beech seedlings, saplings, and poles can persist for a long time under a dense canopy and then respond to release. Many intermediate and intolerant species in these mixed hardwood stands developed in large openings due to windthrow, fire, snow, ice, logging, etc.

Reproduction of intermediate tolerant species usually follows a moderate opening of the canopy and can persist for several years. Seeds of white ash, yellow poplar, and black cherry germinate when favorable conditions of light, temperature, and moisture are created by canopy removal. Because of the abundance of different species in these stands, it is rare that seed crops do not occur for several of these species.

Sources of reproduction in these stands include buried seed, stump sprouts, root suckers, and advance regeneration. Seed of several species such as yellow poplar, basswood, white ash, black locust, and black cherry remain viable in the forest floor for at least three winters. Acorns and seed from maples, birches, and beech commonly remain viable over one winter. Nearly all hardwood species sprout vigorously especially when young, but as stems mature, sprouting decreases. Advance regeneration of tolerant species such as maples and beech occurs under dense canopies. Advance oak regeneration composed of seedlings an inch or more in base diameter, with a well-developed root system, is generally necessary for satisfactory growth after release. Logging usually does not kill advance regeneration because the damaged stems sprout vigorously. During their early years, sprouts grow rapidly, often dominating other forms of reproduction, and can produce high-quality trees for a number of species. Prolific sprouters include oaks, yellow poplar, basswood, black cherry, red maple, black locust, and beech.

Appalachian mixed hardwoods usually have a rich, varied understory and are noted for abundance of spring wildflowers. Spicebush is a key indicator shrub, and the typical large shrubs or small trees include flowering dogwood, sassafras, hawthorns, eastern hophornbeam, American hornbeam, striped maple, serviceberry, sumacs, and redbud. Among the lower-growing woody plants, vines often dominate over erect shrubs. These include greenbrier, grapes, blackberries, Virginia creeper, poison ivy, blueberries, witch hazel, spicebush, teaberry, and mountain laurel.

Due to the mesic conditions found in this forest type and typical locations in coves and on north- and east-facing slopes, fires were infrequent, of low intensity, and generally contained to the surface. This type is considered to be in Fire Regime Group III, with fire frequency return intervals estimated at 30 to 100+ years (Davenport 2005). The variance of species in this type is related to precipitation cycles and proximity to the more fire prone mixed oak and pine-oak types. In those areas with less precipitation or closer to more fire prone types, there is a greater likelihood the species mix will include more shade-intolerant trees. Conversely, those areas with higher precipitation or locations near streams and shade- protected areas, the species mix will be of more shade-tolerant trees. Large-scale natural disturbances also provide opportunities to change from shade-tolerant trees to more shade-intolerant trees.

Northern Hardwoods Type - This type is normally found at the higher elevations, comprising about 22 percent of the forested area on the MNF, with 95 percent in the mid to late successional stages and 2 percent in stands less than 20 years old. At its highest limits, the type may merge with red spruce or may occupy areas where red spruce was formerly abundant but has been depleted by cutting and fire. When found at lower elevations on the good and excellent sites, this type often merges with Appalachian mixed hardwoods and, depending on the cutting practices, it may replace the Appalachian mixed hardwood type or be replaced by it. Repeated cuttings, wildfire, and past land use have created numerous combinations of stand conditions, age classes, and species.

Sugar maple, beech, and yellow birch are the major species and together comprise most of the stocking. Associated in varying mixtures are red maple, hemlock, black cherry, basswood, white ash, and red spruce. Noncommercial understory species include striped maple, hobblebush, eastern hophornbeam, witch hazel, pin cherry, viburnums and serviceberry.

Most commercial tree species typically reproduce from seed, and some also reproduce by vegetative means. Yellow birch seeds prolifically, producing reasonably good crops every other fall. White ash, sugar maple, and beech produce good crops at intervals of as long as 3 to 8 years. Red maple produces abundant seed nearly every spring and sprouts prolifically from stumps of young or mid-aged trees. Sugar maple, beech, and yellow birch sprout reasonably well from stumps of small trees. Beech sprouts on larger stumps generally are short lived but it root-suckers prolifically, especially following cutting. Striped maple also sprouts prolifically, while brambles and pin cherry reproduce from seed buried in the upper soil horizon for as long as 100 years, though numbers decline sharply after 40 years.

Species in this type differ in shade tolerance, longevity, and growth rate. Yellow birch, white ash, and red maple are all intermediate in shade tolerance, but while the latter two have moderately fast growth rates, yellow birch has only a moderate growth rate. Sugar maple, beech, and red spruce are shade-tolerant, long-lived species with moderately slow growth rates. Hemlock is also shade tolerant and long-lived and while it grows rapidly in diameter, it grows slowly in height. Tolerant small trees and shrubs such as striped maple, eastern hophornbeam, and hobblebush affect silvicultural procedures. Pin cherry, a very shade-intolerant small tree, can be a serious competitor in clearcuts.

Similar to the spruce-fir types, the northern hardwoods are considered to be in Fire Regime Group V, with rare but severe fire return intervals averaging 500 years. Without wind-associated events the stand-replacement frequency may be as long as 5,000 years (Cleland, Merzenich, and Swaty 2005). This forest type is considered to be fire resistant because it is typically found in moister areas of the Forest. The higher moisture content results in more rapid decomposition of litter and fine woody debris on the forest floor. Low light and high humidity combine to inhibit the ignition and spread of fire. More frequent disturbances from ice storms, wind throw, and insect attacks contribute to fuel loads. As the fuel loads increase, they can dry quickly where the disturbed areas are large enough for the sun and wind to reach the downed woody material. These conditions may lead to severe fires during drought periods. However, the size of individual fires are typically smaller than in spruce-fir types because they usually remain on the surface and are not carried by a continuous conifer crown cover. Most fires that begin in the northern hardwood type tend to move slower or smolder in the duff of decayed organic material and die out before damaging overstory trees.

The highly shade-tolerant beech and sugar maple are the most common tree species in the understory of northern hardwood stands on well-drained sites. Red spruce and hemlock are more commonly found on wet or excessively well-drained sites. These species and the other long-lived tolerant species, when established, can respond to release after long periods of suppression. Yellow birch needs overhead light and a seedbed of moist humus or mineral soil for optimum early establishment and development. Yellow birch must become dominant early in life to survive to maturity. The capacity of birch and other less-than-tolerant species to respond to release after suppression is moderate to poor.

ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Laws, Regulations, and Policies

Numerous, laws, regulations, and policies govern the management of vegetation on NFS lands. National laws and regulations have also been interpreted for implementation in Forest Service Manuals, Handbooks, and Regional Guides. Vegetation management activities and the timber suitability assessments must comply with these laws, regulations, and policies, which are intended to provide general guidance for the implementation of timber management practices, and for protection of resources. Some of the more important laws and regulations influencing timber management are listed in Table VE-5.

Forest Plan Direction

Forest Plan direction has been developed to enhance, maintain, or restore forest ecosystems through vegetation management to achieve desired conditions on NFS lands. Direction occurs at both the Forest-wide and Management Prescription levels. Goals and objectives have been designed to provide a range of age classes in forested stands with diverse vegetative composition and structure. This range of diversity provides habitats for native and desired non-native plant, wildlife, and aquatic species, while maintaining, enhancing, or restoring ecosystem functions and processes. Standards and guidelines have been designed to provide vegetation management direction, limitations, and advice while protecting other resources that could be adversely affected by project activities. Some 1986 Plan direction has been removed such as items that repeated existing law or policy, if it conflicted with other resource management direction, or were no longer applicable due to changed conditions. Management direction for other resource programs was developed in an integrated manner to provide additional guidance for resource protection.

Table VE-5 – Major Laws and Policies Influencing Vegetation Resource Management

Act/Law/Regulation/Policy	Date	Law/CFR/FSM/FSH Number
Organic Administration Act	06/04/1897	30 Stat.11
Weeks Law	03/01/1911	P.L. 61-435
Knutson-Vandenberg Act	06/09/1930	P.L. 71-319
Sustained Yield Forest Management Act	03/29/1944	P.L.78-273
Federal Insecticide, Fungicide, and Rodenticide Act	06/25/1947	P.L. 80-104
Granger-Thye Act	04/24/1950	P.L. 81-478
Multiple Use-Sustained Yield Act	06/12/1960	P.L. 86-517
National Environmental Policy Act	01/01/1970	P.L. 91-190
Endangered Species Act	12/28/1973	P.L. 93-205
Eastern Wilderness Act	01/03/1975	P.L. 93-622
Forest and Rangeland Renewable Resources Planning Act	08/17/1974	P.L. 93-378
Federal Noxious Weed Act	01/03/1975	P.L. 93-629
National Forest Management Act	10/22/1976	P.L. 94-588
Forest and Rangeland Renewable Resources Research Act	06/30/1978	P.L. 95-307
Healthy Forest Restoration Act	12/03/2003	P.L. 108-148
Forest Service Manual (FSM) - Planning	Updated as needed	FSM 1900
FSM – National Forest Resource Management	Updated as needed	FSM 2060-2080
FSM – Environmental Management	Updated as needed	FSM 2150
FSM – Timber Management	Updated as needed	FSM 2400
FSM – Forest Pest Management	Updated as needed	FSM 3400
FSM – Fire Management	Updated as needed	FSM 5100
Forest Service Handbook (FSH) – Timber Resource Planning	Updated as needed	FSH 2409.13
FSH – Timber Sale Administration	Updated as needed	FSH 2409.15
FSH – Silvicultural Practices	Updated as needed	FSH 2409.17
FSH – Timber Sale Preparation	Updated as needed	FSH 2409.18
FSH –K-V Funds	Updated as needed	FSH 2409.19

Forest Plan Implementation

Proper vegetation management depends on current and site-specific information about environmental conditions and the effects that these activities may have on other resources. Some of these conditions are not appropriately addressed at the Forest Plan programmatic level. Detailed silvicultural prescriptions, prescribed burning plans, biological evaluations, and mitigating measures are written and approved prior to implementation of individual projects.

These descriptions and analyses are designed to address the current and on-the-ground resource conditions. Through the project implementation process, adjustments are made to address resource concerns in a timely, effective, and site-specific manner. Additionally, during project planning, site-specific evaluations are conducted to verify the suitability classification of National Forest System timber lands within the project area. Appropriate site-specific mitigations from the project planning documentation are then incorporated into implementation guides and contract specifications that are applied and administered by Forest Service personnel and contractors.

Effects Common to All Alternatives

Forest ecosystems are constantly changing due to natural processes of forest succession and human activity. These changes are dependent on inherent ecological capability and environmental variability such as soils, topography, and climate. Wind and ice storms, insect infestations, disease outbreaks, floods, and fires can occur locally within small stands or affect multiple large stands or even landscapes. Forest management activities—such as road building, prescribed burning, wildfire suppression, recreation, timber harvesting, grazing, wildlife management, and mineral extraction—can compound or enhance the natural changes. The introduction of non-native plants due to these management activities can have a major influence on native plants, soil structure, and fire regime conditions. Regardless of whether the cause is natural or human, forest succession is constantly changing and will continue on the MNF. Alternatives will differ based on the amount of acres allowed to grow with little or no human disturbance compared to the amount of acres where active management is allowed or emphasized.

General Effects from Managing for Age Class Diversity

Age class diversity, species or forest type composition, and forest health are all inter-related. A forest comprised of one species/forest type or one age is not diverse and is potentially more susceptible to insect or disease outbreaks, wildfire, and other disturbances. Sustainability is the capacity to manage the variety of resources in a forest over the long term thereby ensuring habitats and products are available for generations into the future.

The direct effects of creating early successional habitat through timber harvest are expected to be localized and generally short term (3-12 years). As the seedlings and stump sprouts respond to the increased light with associated increases of available moisture and nutrients, regeneration is usually established rapidly within the first 3 to 5 years. Crown closure of the young saplings normally occurs within 8 to 12 years. While the direct effects are short term, the long-term effect would be a greater diversity in age across the landscape, resulting in sustainable supplies of mast production and commercial timber products.

Creating young forests through deliberate actions creates diversity in forest structure and development stages across the landscape and over time. This diversity in structure creates a variety in habitat conditions for wildlife and plant species. With a greater diversity of ages and structure at the landscape level, the result would be a healthier forest with reduced susceptibility for large-scale pathogen outbreaks and other disturbances. Future age class distribution will vary among alternatives depending on the management emphasis and intensity (amount and type of activity allowed).

General Effects from Not Managing for Age Class Diversity

Most of the Forest would not be actively managed to create diversity in the age classes. In these areas succession will continue, with some stands becoming dominated by shade-tolerant species such red and sugar. Trees that are intolerant or moderately intolerant of shade such as black cherry, oaks, hickories, yellow poplar, and ash will be less common. However, forest development would continue as stands grow in vertical structure through creation of small gaps from single tree or groups of trees dying. In unmanaged stands it is expected that standing dead and fallen trees would increase as the stands age.

With most of the mast-producing stands around a similar age, it is expected that hard mast production will begin to decline within the next 30 to 50 years. Young stands would not be created to replace older stands that are declining in hard mast production. The result would be a substantial reduction in hard mast production in the mixed oak-hickory and pine-oak forest types as they convert to mixed hardwood and pine forest types.

Natural, unplanned disturbance events such as fire, wind and ice storms, and insect/disease outbreaks will provide early successional habitat in scattered patches of various sizes on all forested lands within the MNF proclamation boundary. Wind and ice storms are usually low-level disturbance events and have occurred historically in unpredictable patterns and cycles. High-level disturbance storm events (stand replacement creating blocks of early successional habitat) occur very infrequently (100 to 1,000 years).

In general, old forests are more susceptible to insect and disease infestations, creating conditions for multi-aged stands to develop over time. Sustainability of commercial timber products is unlikely in passively managed areas of the Forest because commercial timber harvest generally is not allowed. However, in those MPs that allow active management, uneven-age silvicultural management practices would allow some sustainable commercial timber harvest, but the long-term effect would still be conversion of an even-age forest dominated by trees intolerant and moderately intolerant to shade to an uneven-age forest dominated by shade-tolerant vegetation.

General Effects from Active Spruce Restoration

Actively restoring red spruce would accelerate the rate of increase in red spruce dominance or regeneration that is occurring now. In areas where red spruce is found in the understory, commercial or non-commercial actions could be taken to release the understory, allowing red spruce to move into the overstory more quickly. The Spruce-Fir forest type would expand more rapidly toward pre-20th century conditions.

General Effects from Passive Spruce Restoration

Red spruce trees are regenerating naturally on the MNF. Because red spruce is tolerant of shade, it can persist and grow slowly in the understory for up to 100 years and respond to release as surrounding trees die. However, the longer red spruce is suppressed in the understory the longer it will take to recover from a release, which may allow other faster-growing species to outgrow it. Many of the stands with a red spruce component in the understory are 70 to 90 years old. The red spruce that is in the understory most likely has been suppressed during this time. Since a release is not planned in most of these passive restoration areas, it is likely that much of the red spruce in the understory will die within the next 10 to 30 years. Overall, the range of red spruce would continue to expand toward pre-20th century conditions but at a much slower rate than areas actively managed.

American beech mortality due to beech bark disease and eastern hemlock mortality due to the hemlock wooly adelgid will likely create numerous openings for red spruce regeneration or release. However, beech sucker sprouting may interfere and suppress the regeneration and growth of red spruce seedlings. Without active management to reduce the competition from beech suckers, red spruce would continue to expand in its range but at a much slower rate.

General Effects from Active Oak Restoration

With the application of prescribed fire or herbicides the succession from oak-dominated forests to maple, birch, or beech-dominated forests would be slowed. With the reintroduction of prescribed fire as a recurring disturbance regime, oaks may again be self-perpetuating on many sites. Other silvicultural treatments—such as planting combined with fencing or tree shelter protection and crop tree release—can enhance oak survival and growth. Individual or combinations of site-specific prescribed treatments, along with deer population control, are needed to maintain a long-term sustainable supply of oak trees and hard mast production.

General Effects from Not Managing for Oak Restoration

Many stands currently dominated by oak species in the Mixed Oak forest type would gradually convert to the mixed hardwood forest type as maple, basswood, and other trees tolerant of shade grow in the understory and eventually replace oaks in the late successional stage. In areas where the overstory oaks are removed through commercial timber harvest but actions are not taken to ensure oak regeneration, stands would likely become dominated by species other than oaks.

General Effects from Disturbance Processes

Prescribed Fire and Wildfire - Fire is a disturbance event that is both natural and human-caused and has occurred in forested stands for thousands of years. Nature-caused fires are unplanned, sporadic events, while the human use of fire has increased over time until about 60 years ago when fire suppression became an active form of management. Periodic human-caused fires generally burn with low intensity in a mosaic pattern. Stand-replacement fires generally occurred only during periods of drought or after storm events left large amounts of dead and down trees that increased fuel loads. Oaks have increased in numbers and locations after humans learned to use fire as a tool several thousand years ago (Brose et al 2001). Although oaks do not require fire to be present in an area, fire appears to be an important factor in perpetuating oak dominance by eliminating or reducing the number of trees (such as trees with thin bark or trees that do not sprout when the tops are killed or removed) that are more susceptible to mortality caused by fire.

Forest Insects/Diseases - Native insects and diseases are vital parts of healthy functioning forest ecosystems. It is not the purpose of active forest management activities to eradicate native insects or pathogens on a broad scale. They can influence forest type/species composition, diversity, and forest health by:
- Controlling populations of woody and herbaceous plants,
- Regulating carbon and nutrient cycling,
- Serving as a food source for vertebrates and invertebrates,
- Pollinating plants, and
- Acting as mycorrhizal symbionts.

In contrast, non-native insects and diseases are not normal parts of the ecosystems on the MNF. Although some of the influences are similar to native insects and diseases, the magnitude of the effects are more extreme and can greatly reduce or eliminate native plant populations. This is because predators, parasites, and diseases that controlled these non-native invasive insects and diseases in their home habitats are not present here, allowing unregulated growth of their populations (SAMAB 1996). It is unlikely that the introduction and spread of NNIS can be completely prevented. Projected low funding levels for integrated pest management activities, combined with increased access from management and recreation activities and a steadily increasing number of non-native species being introduced into this country, will make it difficult to prevent new occurrences. Increased access would make it more likely that new infestations could be treated more rapidly and cost efficiently, although the increased access also makes it more likely that NNIS would be introduced into the area. However, in those remote areas without access and little or no management activities, any NNIS introduction may become widespread before it is discovered, making eradication or control efforts more difficult and costly.

Pre-settlement patterns of insect/disease outbreaks are unknown but were probably cyclical with stand-replacement events occurring rarely at unpredictable intervals. Post-settlement insect or disease outbreaks most likely have increased in quantity and intensity because of the introduction of non-native insects and diseases.

Direct and Indirect Effects by Alternative

Issue #1 - Age Class Diversity

Age Class Distribution in MPs 3.0 and 6.1 by Alternative

The amount of regeneration harvest treatments in those MPs that allow active management would affect the future quantity of successional stages or age classes. MPs 3.0 and 6.1 have by far the most potential for change related to regeneration harvest. Under Alternative 1, MPs 2.0 and 4.0 allow commercial timber harvest, but MP 2.0 emphasizes uneven-aged harvest on only 13,700 acres, while MP 4.0 is only comprised of 400 acres. For Alternatives 2, 3, and 4, MP 4.1 allows commercial timber harvest, but regeneration harvest for age class diversity would only occur on a relatively small portion of the total acres. The majority of this MP would emphasize passive restoration of spruce or spruce-hardwood ecosystems, or active thinning or release treatments to promote spruce ecosystem recovery.

Age class changes were computed by the SPECTRUM model, using a combination of current conditions, predicted treatments, and management constraints. See Appendix B of this EIS for more information on vegetation modeling using the SPECTRUM model.

Table VE-6 shows the age class changes predicted as a result of vegetation management in MP 3.0 by alternative at the end of the first, fifth, and tenth decades of management.

Table VE-6. Age Class Distribution Percentages in MP 3.0 by Alternative After Decades 1, 5, and 10

Alternative 1 – MP 3.0					
Time Frame	Percent of Age Class or Successional Stage				
	Early (0-19 years)	Early to Mid (20-39 years)	Mid (40-79 years)	Mid to Late (80-119 years)	Late (≥120 years)
Current Distribution	4.6	4.8	31.1	54.1	5.4
End of 1st Decade	5.9	4.8	31.1	52.7	5.5
End of 5th Decade	15.4	17.1	10.7	19.2	37.6
End of 10th Decade	9.4	12.7	19.4	17.9	40.6

Alternative 2 – MP 3.0					
Time Frame	Percent of Age Class or Successional Stage				
	Early (0-19 years)	Early to Mid (20-39 years)	Mid (40-79 years)	Mid to Late (80-119 years)	Late (≥120 years)
Current Distribution	4.2	4.5	33.0	54.5	3.8
End of 1st Decade	13.2	4.6	33.0	45.4	3.8
End of 5th Decade	20.0	19.0	17.8	17.9	25.3
End of 10th Decade	15.9	18.2	23.4	21.9	20.6

Alternative 2M – MP 3.0					
Time Frame	Percent of Age Class or Successional Stage				
	Early (0-19 years)	Early to Mid (20-39 years)	Mid (40-79 years)	Mid to Late (80-119 years)	Late (≥120 years)
Current Distribution	4.2	4.4	33.0	54.6	3.8
End of 1st Decade	13.1	4.5	33.0	45.6	3.8
End of 5th Decade	20.0	19.1	17.6	17.8	25.6
End of 10th Decade	15.8	18.0	23.7	22.0	20.6

Alternative 3 – MP 3.0					
Time Frame	Percent of Age Class or Successional Stage				
	Early (0-19 years)	Early to Mid (20-39 years)	Mid (40-79 years)	Mid to Late (80-119 years)	Late (≥120 years)
Current Distribution	4.3	4.5	32.5	54.7	4.0
End of 1st Decade	13.0	4.5	32.5	46.0	4.0
End of 5th Decade	20.0	17.9	17.5	17.8	26.8
End of 10th Decade	14.5	18.5	24.6	22.2	20.2

Alternative 4 – MP 3.0					
Time Frame	**Percent of Age Class or Successional Stage**				
	Early (0-19 years)	**Early to Mid (20-39 years)**	**Mid (40-79 years)**	**Mid to Late (80-119 years)**	**Late (≥120 years)**
Current Distribution	4.1	4.4	34.3	53.5	3.7
End of 1st Decade	13.9	4.4	34.3	43.7	3.7
End of 5th Decade	19.8	19.5	16.4	13.3	31.0
End of 10th Decade	11.8	15.7	26.5	23.5	22.5

Table VE-7 shows the age class changes predicted as a result of vegetation management in MPs 6.1 by alternative at the end of the first, fifth, and tenth decades of management.

Table VE-7. Age Class Distribution Percentages in MP 6.1 by Alternative After Decades 1, 5, and 10

Alternative 1 – MP 6.1					
Time Frame	**Percent of Age Class or Successional Stage**				
	Early (0-19 years)	**Early to Mid (20-39 years)**	**Mid (40-79 years)**	**Mid to Late (80-119 years)**	**Late (≥120 years)**
Current Distribution	3.8	4.8	32.2	54.6	4.6
End of 1st Decade	9.6	4.8	32.2	48.8	4.6
End of 5th Decade	14.7	12.8	14.4	21.0	37.1
End of 10th Decade	14.9	13.2	18.7	16.1	37.1

Alternative 2 – MP 6.1					
Time Frame	**Percent of Age Class or Successional Stage**				
	Early (0-19 years)	**Early to Mid (20-39 years)**	**Mid (40-79 years)**	**Mid to Late (80-119 years)**	**Late (≥120 years)**
Current Distribution	3.7	4.8	23.9	61.6	6.0
End of 1st Decade	8.3	4.8	21.7	59.4	5.8
End of 5th Decade	10.2	8.1	13.1	18.4	50.2
End of 10th Decade	11.2	10.5	15.3	13.3	49.7

Alternative 2M – MP 6.1					
Time Frame	**Percent of Age Class or Successional Stage**				
	Early (0-19 years)	**Early to Mid (20-39 years)**	**Mid (40-79 years)**	**Mid to Late (80-119 years)**	**Late (≥120 years)**
Current Distribution	3.8	5.0	23.7	61.4	6.1
End of 1st Decade	8.5	5.0	21.7	58.8	6.0
End of 5th Decade	10.2	7.9	13.5	18.3	50.1
End of 10th Decade	11.4	10.9	15.3	13.4	49.0

Alternative 3 – MP 6.1					
Time Frame	Percent of Age Class or Successional Stage				
	Early (0-19 years)	Early to Mid (20-39 years)	Mid (40-79 years)	Mid to Late (80-120 years)	Late (>120 years)
Current Distribution	4.1	4.8	25.6	59.6	5.9
End of 1st Decade	5.8	4.8	25.6	57.9	5.9
End of 5th Decade	9.2	9.1	10.6	20.4	50.7
End of 10th Decade	10.0	9.7	14.2	12.7	53.4

Alternative 4 – MP 6.1					
Time Frame	Percent of Age Class or Successional Stage				
	Early (0-19 years)	Early to Mid (20-39 years)	Mid (40-79 years)	Mid to Late (80-120 years)	Late (>120 years)
Current Distribution	3.6	4.6	24.1	61.7	6.0
End of 1st Decade	12.3	4.6	22.1	56.0	5.0
End of 5th Decade	10.6	7.4	17.0	15.7	49.3
End of 10th Decade	9.8	10.1	18.0	15.1	47.0

Alternative 1 – MPs 2.0, 3.0, 4.0, and 6.1 contain an estimated 332,200 acres of MNF lands that can be actively managed for timber in this alternative. One major constraint that restricts regeneration harvests on suitable timber lands is the 200-year rotation cycle for most forest types. This averages to ½ percent per year of regeneration harvest to attain a balanced age class distribution on those acres that can be actively managed. On 332,200 acres it would be necessary to annually regenerate an average of 1,661 acres to balance age classes over the 200-year rotation cycle. If this alternative were to achieve desired conditions in the 2006 Forest Plan in a 10-decade time frame, it is estimated that annually, 4,200 acres would be regenerated into early successional stands, or about 0.5 percent of the total MNF acres.

On the remaining 585,200 acres, only natural disturbance events would contribute to creating early successional habitat. A balanced age class distribution is not achievable through natural processes in a 200-year rotation cycle.

Alternative 2, 2M, 3, and 4 - In Alternatives, 2, 3, and 4 a maximum of 15 percent of the acres may be regenerated over the next decade in the MPs that allow timber harvest activities. Most of these acres would come from the mid- and mid- to late successional stage stands, which presently make up 88 percent of the acres on the MNF. Meeting the maximum allowable regeneration would substantially increase the amount of early successional habitat on the Forest. However, a large majority of the Forest would remain in the older age classes.

Acres were re-allocated in MP 6.1 in these alternatives, placing more of the high-quality mixed hardwood forest types into 3.0 MP and the low-quality mixed oak forest types into MP 6.1. Due to this reallocation the Spectrum model preferred to harvest the high-quality sites first in the earlier decades in MP 3.0 and the lower-quality sites in MP 6.1 in the later decades. Most likely this is why the age classes are more evenly distributed by the end of the fifth decade in MP 3.0 areas. However, in MP 6.1 areas in all alternatives there is still a high percentage of acres in the late successional stage, ranging from 37.1 percent in Alternative 1 to 53.4 percent in Alternative 3 by the end of the 10^{th} decade.

Alternative 2 – In MPs 3.0, 4.1, and 6.1, approximately 330,300 acres are available for active management in this alternative. Annually, an estimated maximum of 3,400 acres would be regenerated into early successional stands, or about 0.4 percent of the total MNF acres. Another way of interpreting this is, on an annual basis approximately 99.6 percent of the MNF acres would continue to move toward older age classes. An estimated 587,100 acres are not suitable for timber management in this alternative, and only natural events would contribute to creating early successional habitat in these areas.

In this alternative there would be a maximum increase of 7.3 percent in MP 3.0 in the early successional age class by the end of the first decade compared to Alternative 1.

Alternative 2 Modified – In MPs 3.0, 4.1, and 6.1, approximately 329,400 acres are available for active management in this alternative. Annually, an estimated maximum of 3,400 acres would be regenerated into early successional stands, or about 0.4 percent of the total MNF acres. Another way of interpreting this is, on an annual basis an estimated 99.6 percent of the MNF acres would continue to move toward older age classes. An estimated 588,000 acres are not suitable for timber management in this alternative, and only natural events would contribute to creating early successional habitat in these areas.

In this alternative there would be a maximum increase of 7.2 percent in MP 3.0 in the early successional age class by the end of the first decade compared to Alternative 1.

Alternative 3 – Approximately 253,400 acres are available for timber harvest in MPs 3.0, 4.1 and 6.1 in this alternative. Annually, an estimated maximum of 2,400 acres would be regenerated into early successional stands, or about 0.3 percent of the total MNF acres. In this alternative about 99.7 percent of MNF acres, on an annual basis, would continue to move toward older age classes, with about 664,000 acres that would not be suitable for timber management.

In this alternative there would be a maximum increase of 7.1 percent in MP 3.0 in the early successional age class by the end of the first decade compared to Alternative 1.

Alternative 4 - This alternative has about 346,700 acres available for timber harvest in MPs 3.0, 4.1, and 6.1. Annually, an estimated maximum of 5,200 acres would be regenerated into early successional stands, or about 0.6 percent of the total MNF acres. About 570,700 acres are not suitable for timber harvest in this alternative.

In this alternative there would be a maximum increase of 8.0 percent in MP 3.0 in the early successional age class by the end of the first decade compared to Alternative 1.

Over the majority of the MNF, 64 to 72 percent of the forested acres that are not suitable for timber management (depending on the alternative) would continue to age and move into older age classes. Alternative 4 has the fewest acres that are not suitable for timber management, while Alternative 3 has the most acres that are not suitable.

Issue #2 - Vegetation Restoration

Acres of Potential Passive and Active Spruce Restoration by Alternative

The vegetation management strategy for spruce restoration is much the same across all the alternatives because it is essentially derived from the Forest Plan Threatened and Endangered Species Amendment of 2004. Land mapped as suitable habitat for West Virginia northern flying squirrel would receive relatively little active management, as the overall strategy is to allow red spruce and spruce-hardwood stands to grow older through time and develop an uneven-aged stand structure. Management may occur to enhance or maintain this habitat, or for research related to how best to achieve this objective, but the amount and intensity of management is expected to be relatively low under any alternative.

The total amount of potential restoration (both passive and active) that could occur is shown in Table VE-8 by alternative. These acres were calculated by adding all the areas of spruce and spruce-hardwood ecosystems that will be at least 80 years old 50 years from now in MPs 4.1, 6.2, 5.0, 5.1, and 8.0 (including the 8.1 NRA in the action alternatives) by alternative, plus any additional spruce or spruce-hardwood stands in other areas that would receive little or no active management, such as WVNFS suitable habitat, Indiana bat key areas, stream channel buffers, eligible Wild and Scenic River corridors with a Wild classification, etc.

Table VE-8. Total Acres of Potential Spruce Restoration Areas

Alternative 1	Alternative 2	Alternative 2M	Alternative 3	Alternative 4
130,000	140,000	140,000	140,000	140,000

Table VE-8 shows that there is little difference in overall potential spruce restoration under any alternative, and no difference among the action alternatives that could be implemented under the 2006 Forest Plan. The 10,000-acre difference in the No Action Alternative is a result of northern hardwood areas that fall within MPs 3.0 or 6.1 that would emphasize even-aged regeneration harvests instead of spruce restoration.

West Virginia northern flying squirrel habitat is captured by OA 832 in Alternative 1, and within portions of MP 4.1 in Alternatives 2, 2M, 3, and 4. MP 4.1 was also designed to include areas on the Forest that are not now suitable for WVNFS habitat, but have the potential to grow spruce and become suitable habitat at some point in the future. In fact, MP 4.1 has the following vegetation management objective:

> Within stands where spruce can be restored, enhanced, or maintained, conduct approximately 1,000 to 5,000 acres of species composition and habitat structure enhancement work over the next 10 years.

Alternative 1, No Action, has no such objective. Although active spruce restoration treatment could occur under any of the action alternatives, there are Management Prescription areas with spruce restoration potential in each alternative where commercial timber harvest is essentially prohibited. These areas are MPs 5.0 (Wilderness), 5.1 (Recommended Wilderness), 6.2 (Backcountry Recreation), and some 8.0 (Special Areas such as Biological Areas, Scenic Areas, National Natural Landmarks, and candidate Research Natural Areas). The 5.0 areas do not change by alternative, but the 5.1, 6.2, and 8.0 MP areas do. Therefore, the amount of acres available for active spruce restoration varies somewhat by alternative. These differences are shown in Table VE-9 as the acres of northern hardwood stands in MP 4.1, but not in WVNFS suitable habitat, that would be at least 80 years old at the end of the fifth decade.

Table VE-9. Acres Available for Active Spruce Restoration 50 Years From Today

Acres Available for Restoration	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
All Potential Acres in MP 4.1	0	23,000	24,000	9,000	34,000

Although the acres in Table VE-9 are only intended as a relative comparison of areas that could provide opportunities for active spruce restoration under each alternative, the analysis indicates that opportunities would likely be the greatest under Alternative 4, followed in descending order by Alternatives 2M, 2, 3, and 1.

The most important difference among the alternatives is that Alternative 1, represented by the 1986 Plan as amended, has no desired condition or objective to restore spruce and spruce-hardwood ecosystems, whereas the action alternatives do. Restoration would still occur in Alternative 1, but it would likely be at a slower pace because it would be dependent on the ecological processes associated with natural succession. However, under all alternatives most spruce restoration would occur passively, as a result of these natural processes.

Acres of Oak Forest Types Within MP 6.1 by Alternative

Unlike spruce restoration described above, oak restoration would focus on active vegetation management tools such as even-aged timber harvest and prescribed fire. Although some harvest-related oak restoration could also occur in MPs 3.0 and 8.1, most of the direction and opportunities for oak restoration are associated with MP 6.1. This MP area not only includes a majority of the declining oak communities on the Forest, but it also has suitable timberlands with a wildlife habitat management emphasis. Suitable acres of mixed oak and pine-oak forest types in MP 6.1 are shown in Table VE-10 by alternative. These acres represent the most likely area where oak restoration would occur using commercial timber harvest as a tool.

Table VE-10. Acres of Oak Forest Types Within MP 6.1 by Alternative

Oak Types within MP 6.1	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Acres of mixed oak in MP 6.1	66,300	97,500	97,300	55,700	106,000
Acres of pine-oak in MP 6.1	18,600	28,500	28,500	12,200	31,200
Total Acres	84,900	126,000	125,800	67,900	137,200

Alternative 1 – The No Action Alternative has an estimated 84,900 acres of oak forests in 6.1 areas where active harvest-related restoration would be most likely to occur. However, it is important to note that the 1986 Forest Plan has no desired conditions or objectives related to restoring oak ecosystems, in MP 6.1 or otherwise. Desired conditions for MP 6.1 include:

> Management emphasis will focus on manipulation of the naturally occurring tree species composition to optimize hard mast production, age class distribution, and ensure a continuous mast supply. (p. 165)

This statement can be interpreted that management should strive to maintain or enhance oak species and communities, as they are primary producers of hard mast, but there is no explicit direction or information in the 1986 Plan about the need to restore these declining ecosystems, or the amount of restoration that should occur.

Alternatives 2, 2M, 3, and 4 – The action alternatives have specific emphasis and direction to achieve oak restoration under MP 6.1. Specifically, desired conditions for MP 6.1 in the 2006 Forest Plan include the following statement:

> On sites where existing vegetation includes an oak component, oak restoration management focuses on achieving and maintaining oak-dominated species composition, as well as developing the more open stand structure that likely existed in these communities prior to a period of extensive fire suppression that began about 70-80 years ago. (Chapter III, MP 6.1, Desired Conditions)

There is a corresponding goal (6102) in the revised 6.1 management direction to:

> Maintain, restore, or enhance the oak component within oak-pine and oak-hickory communities to provide long-term mast supplies, sustainable timber, and habitat diversity.

The revised MP 6.1 also includes the following management objectives (6104, 6106) designed to achieve the oak restoration desired conditions:

> Within oak ecosystems that can be restored, enhanced, or maintained, conduct 10,000-15,000 acres of prescribed fire over the next 10 years to enhance species composition and stand structure.
>
> Over the next 10 years regenerate the following amounts of forest vegetation to begin moving toward desired age class and habitat diversity conditions for these forest types:
>
> | | |
> |---|---|
> | White oak: | 2,000-3,000 acres |
> | Red oak: | 6,000-7,000 acres |
> | Mixed oak: | 3,000-4,000 acres |

This suite of revised direction provides much clearer emphasis and guidance for restoring oak ecosystems than that found in the 1986 Plan under Alternative 1.

Alternative 2 – This alternative has an estimated 126,000 acres of oak forests in 6.1 areas where active harvest-related restoration would be most likely to occur. This represents a substantial increase (over 41,000 acres) over the amount of land available for oak restoration in Alternative 1, representing the 1986 Plan as amended.

Alternative 2 Modified - This alternative has an estimated 125,800 acres of oak forests in 6.1 areas where active harvest-related restoration would be most likely to occur. This represents a substantial increase (nearly 41,000 acres) over the amount of land available for oak restoration in Alternative 1, representing the 1986 Plan as amended.

Alternative 3 – This alternative has an estimated 67,900 acres of oak forests in 6.1 areas where active harvest-related restoration would be most likely to occur, considerably less than either Alternatives 1, 2, 2M, or 4. A substantial amount of the available 6.1 land in Alternatives 1 and 2 is shifted to MPs 5.1 and 6.2 under Alternative 3, and commercial timber harvest is prohibited in these prescriptions, lessening the opportunity for oak restoration. The management emphasis and direction for oak restoration under Alternative 3 would be the same as in Alternative 2, but the opportunity would be diminished over the long term.

Alternative 4 - This alternative has an estimated 137,200 acres of oak forests in 6.1 areas where active harvest-related restoration would be most likely to occur, the most of all the alternatives, and 52,300 acres more than Alternative 1. The management emphasis and direction for oak restoration under Alternative 4 is the same as in Alternative 2, but the opportunity would be increased over the long term because there would be more land available for treatment.

For all alternatives, additional oak forests would be available for treatment outside of the suitable acres displayed in Table VE-10. These areas could be treated with a mixture of timber harvest and prescribed fire to achieve oak regeneration; however, funding would likely have to come from different sources than the Timber program. The most total oak forests available would be in Alternative 4 (213,700 acres), followed by Alternative 2 (191,900 acres), Alternative 2M (188,500 acres), Alternative 1 (136,800 acres), and Alternative 3 (110,400 acres).

Acres of FRCC 3 and 2 in MPs 3.0, 6.1, and 8.1 by Alternative

Another important aspect of oak restoration is the use of prescribed fire, either alone or in combination with timber harvest, as an active vegetation management tool to help manage ecosystem composition, structure, and function. Due largely to the intermingled land ownership patterns and the relatively long list of investments and property to protect, management direction in both the 1986 and 2006 Forest Plans emphasizes wildfire suppression across the Forest. Therefore, prescribed burning, rather than natural fire, will be used to return fire to its ecological role on the landscape.

The majority of the declining oak communities on the Forest are found on the eastern portion of the Forest. Over the short and long term, fire management would focus on those areas considered most at risk due to their departure from their natural fire regimes. On the MNF these areas have been identified and mapped as Fire Regime I, Condition Class 3, and Fire Regime III, Condition Class 2. Table VE-11 shows the acres of these FRCC that occur in MPs 3.0, 6.1, and 8.1 by alternative. This combination of MPs and FRCCs represent the most likely areas where oak restoration would occur using prescribed fire as a tool. Prescribed fire would likely be used sparingly in other MPs due to access restrictions, motorized equipment restrictions, scarcity of oak types, other management emphasis, or a combination of the above.

Table VE-11. Acres of FRCC 3 and 2 in MPs 3.0, 6.1, and 8.1 by Alternative (mixed oak and pine-oak forest types only)

Alternative	Management Prescription	Acres by Fire Regime (FR) and Condition Class (CC)		MP Subtotal Acres	Total Acres for All MPs
		FR I, CC 3	FR III, CC 2		
Alt. 1	MP 3.0	13,800	32,200	46,000	**183,200**
	MP 6.1	78,000	59,200	137,200	
Alt. 2	MP 3.0	3,000	16,400	19,400	**198,200**
	MP 6.1	75,100	79,000	154,100	
	MP 8.1	21,100	3,600	24,700	
Alt. 2M	MP 3.0	3,000	16,400	19,400	**195,700**
	MP 6.1	73,200	78,400	151,600	
	MP 8.1	21,100	3,600	24,700	
Alt. 3	MP 3.0	3,000	15,800	18,800	**129,900**
	MP 6.1	31,200	55,200	86,400	
	MP 8.1	21,100	3,600	24,700	
Alt. 4	MP 3.0	3,000	16,400	19,400	**217,300**
	MP 6.1	86,000	87,200	173,200	
	MP 8.1	21,100	3,600	24,700	

Alternative 1 – An estimated 84 percent of the acres in the fire-adapted pine-oak and mixed oak forest types are in MPs 3.0 and 6.1. MP 8.1 does not exist under this alternative. As seen in Table VE-11, this alternative has an estimated 183,200 acres of FR I CC 3 and FR III CC 2 in MP 6.1 where active oak restoration using prescribed fire would be most likely to occur. However, it is important to note that the 1986 Forest Plan has no desired conditions, goals, or objectives related to restoring oak ecosystems in MP 6.1 or using fire to do so. Indeed, prescribed fire is merely allowed in MP 6.1 in the 1986 Plan by the following "general direction":

> Prescribed fire may be used to establish, maintain, or control vegetation. (p.181)

This statement provides no emphasis or direction to use fire to achieve specific ecological goals, objectives, or desired conditions. More importantly, the Forest Plan Amendment for Threatened and Endangered Species (2004) has a Biological Opinion that limits the amount of prescribed fire the Forest may use to 300 acres of year. At that maximum rate, it would take the Forest 611 years to treat the 183,200 acres of the high priority FRCC areas once.

Alternative 2 – An estimated 90 percent of the acres in the fire-adapted pine-oak and mixed oak forest types are in MPs 3.0, 6.1, and 8.1. As seen in Table VE-11, this alternative has an estimated 198,200 acres of FR I CC 3 and FR III CC 2 in these MPs where active oak restoration using prescribed fire would be most likely to occur. In addition, Alternative 2 has specific emphasis and direction to conduct oak restoration under MP 6.1, as described under the first Oak Regeneration indicator above. This suite of revised direction would provide much clearer emphasis and guidance for restoring oak ecosystems than that found in the 1986 Plan under

Alternative 1. At a maximum of 30,000 acres of prescribed fire a decade, it would take the Forest 66 years to treat the 198,200 acres of high-priority FRCC areas once.

Alternative 2 Modified – An estimated 89 percent of the acres in the fire-adapted pine-oak and mixed oak forest types are in MPs 3.0, 6.1, and 8.1. As seen in Table VE-11, this alternative has an estimated 195,700 acres of FR I CC 3 and FR III CC 2 in these MPs where active oak restoration using prescribed fire would be most likely to occur. Like Alternative 2, this alternative has an emphasis on oak forest restoration. At a maximum of 30,000 acres of prescribed fire a decade, it would take the Forest 65 years to treat the 195,700 acres of high-priority FRCC areas once.

Alternative 3 – An estimated 59 percent of the acres in the fire-adapted pine-oak and mixed oak forest types are in MPs 3.0, 6.1, and 8.1. As seen in Table VE-11, this alternative has an estimated 129,900 acres of FR I CC 3 and FR III CC 2 in these MPs where active oak restoration using prescribed fire would be most likely to occur, considerably less than either Alternatives 1 or 2. A substantial amount of the available 6.1 land in Alternatives 1 and 2 shifts to MPs 5.1 and 6.2 under Alternative 3. Although prescribed fire may be used in MPs 5.1 and 6.2 to help restore or maintain fire-dependent ecosystems, there is no particular emphasis or objective to do so. In addition, Alternative 3 would be under the same prescribed fire limit (300 acres maximum a year) as Alternative 1. At that maximum rate, it would take the Forest 433 years to treat the 129,900 acres of high-priority FRCC areas once listed in Table VE-16 above.

Alternative 4 – An estimated 99 percent of the acres in the fire-adapted pine-oak and mixed oak forest types are in MPs 3.0, 6.1, and 8.1. This alternative has an estimated 217,300 acres of FR I CC 3 and FR III CC 2 in MP 6.1 where active oak restoration using prescribed fire would be most likely to occur, the most of any of the alternatives. The MP 6.1 management emphasis and direction for fire-related oak restoration under Alternative 4 would be the same as in Alternative 2, but the opportunity would be increased somewhat over the long term because there would be more land available for treatment. Also, this alternative would have a maximum prescribed fire limit of 7,500 acres a year (see Alternatives Considered in Detail, Chapter 2). At that maximum rate, it would take the Forest 29 years to treat the 217,300 acres of high-priority FRCC areas once listed in Table VE-11.

Cumulative Effects

Issue #1 - Age Class Diversity

Meeting desired age class diversity conditions will require more than one or two decades due to the large amount of acres currently in the mid- and mid-late successional stage. It would be beneficial in the long term to regenerate more acres in this entry period than allowed in the 1986 Plan in order to move toward a better distribution of age classes. This is more critical now because fewer acres were regenerated than anticipated in the previous entry period. With the forest aging, many stands will begin to decrease in mast and timber productivity over the coming decades. Most hard mast tree species take 30 to 50 years to attain optimum mast production. If substantial gains in regenerating stands are not made during the next two to three decades, then a sharp decline of hard mast production will begin to occur in the ensuing decades and continue indefinitely. But even with an increase in regenerated stands now, there will be a period of decline for a couple of decades or more until the regenerated trees grow into their optimum mast-producing years. The most efficient way to sustain large-scale age class diversity through time is to create a young age class on a regulated basis.

The desired condition for most of the forest types in those MPs that have land suitable for timber management is to have 10 to 25 percent of the acres in the 0-19 year (early successional) age class. This means that if the maximum of 15 percent is harvested this decade then in the next decade 0 to 10 percent should be regenerated, depending on the forest type. Conversely, if only 5 percent is harvested this decade, then 5 to 20 percent should be regenerated in the next decade to move toward a more varied distribution of age classes. Any lands managed under the uneven-aged silviculture system remain in the same age class because many of the older aged trees would be retained in the stand after harvesting.

MNF and County Land Age Classes - All forested lands have been categorized into size classes within the counties containing MNF lands and for the MNF. These size classes can be loosely interpreted into successional stages. The seedling/sapling size class can generally be defined as the early successional stage, the poletimber size class as the mid-to-early and mid successional stages, and the sawtimber size class as the mid-to-late and late successional stages. Table VE-12 shows the percent size classes of timber land in counties within the proclamation boundary and on MNF lands. Greenbrier, Nicholas, Grant, and Pendleton Counties have about twice as many acres in the seedling/sapling size class than the other counties within the MNF boundary. In all counties and MNF land the sawtimber size class (mid-to-late and late successional stages) has the majority of the timber land acres. Barbour County only has 11 acres of MNF land and was therefore not included in this analysis.

Table VE-12. Timber Size Classes by Counties with MNF Lands

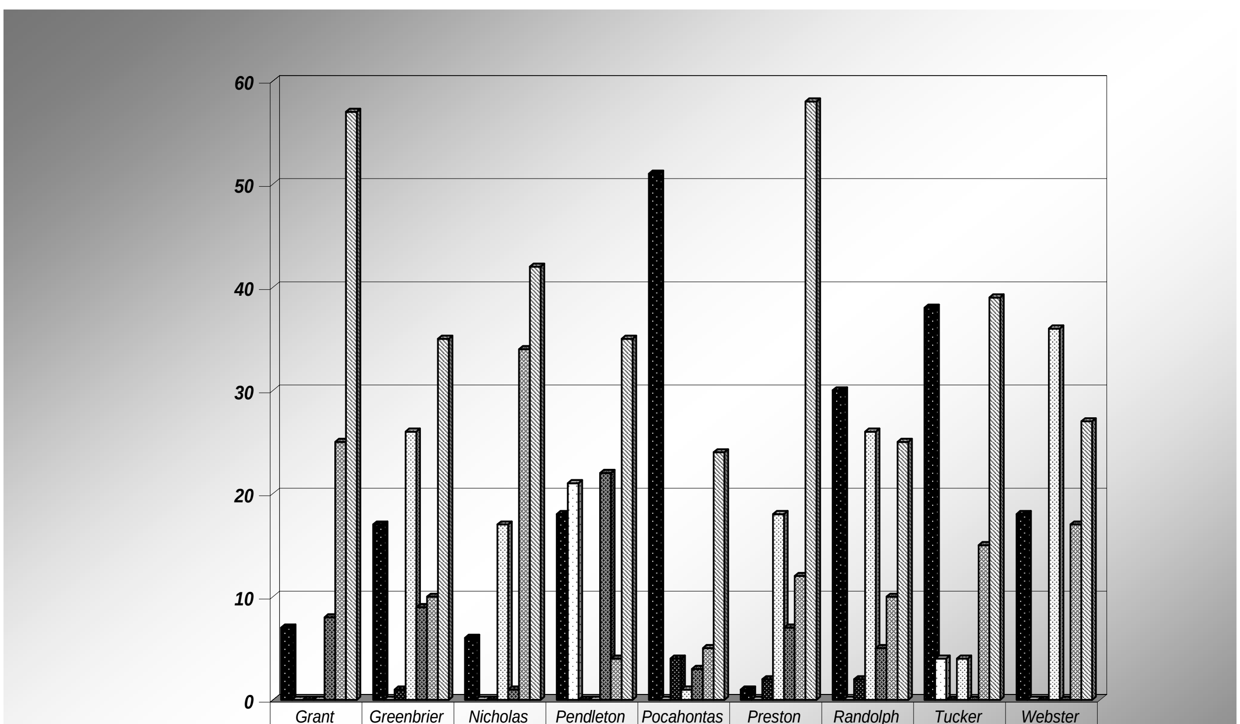
County	% Sawtimber	% Poletimber	% Seedling/Sapling
Grant	51	39	10
Greenbrier	58	29	13
Nicholas	68	18	13
Pendleton	76	18	6
Pocahontas	75	20	5
Preston	69	21	10
Randolph	86	10	4
Tucker	73	24	3
Webster	75	21	4
Monongahela NF	**78**	**18**	**4**

Source: Forest Statistics for West Virginia 1989 and 2000, USDA Forest Service, Northeastern Research Station, Resource Bulletin NE-157 and Forest Resource Statistics for the Monongahela National Forest: 2000, USDA Forest Service, Northeastern Research Station, Resource Bulletin NE-161.

Greenbrier and Nicholas Counties have the most acres in the seedling/sapling stage within the MNF proclamation boundary and Tucker County has the fewest acres. Grant County has just over 50 percent of timberland in the sawtimber size class, while Randolph County has more than 80 percent in sawtimber. Grant and Greenbrier Counties appear to be the closest to balancing size classes on timberland within the county, while Randolph County has the least balanced size class distribution.

Figure VE-1 displays the percent of acres in each county within the MNF proclamation boundary by land ownership class. Pocahontas, Randolph, and Tucker Counties have over 30 percent of their lands under MNF ownership. Pendleton County also has more than 30 percent in federal ownership (Monongahela and George Washington National Forests). These counties have over 70 percent of their timberland in the sawtimber size class and the smallest percentage of acres in the seedling/sapling size class for those counties with MNF lands. Conversely, the counties with the highest percentage of acres owned by individuals, corporations, and industry (Grant, Greenbrier, Nicholas, and Preston) have the smallest percentage of acres in the sawtimber size class and the highest percentage in the seedling/ sapling size class.

Figure VE-1. Land Ownership by County



	Grant	Greenbrier	Nicholas	Pendleton	Pocahontas	Preston	Randolph	Tucker	Webster
MNF	7	17	6	18	51	1	30	38	18
Other Federal	0	0	0	21	0	0	0	4	0
State	0	1	0	0	4	2	2	0	0
Industry	0	26	17	0	1	18	26	4	36
Farmer	8	9	1	22	3	7	5	0	0
Corporate	25	10	34	4	5	12	10	15	17
Individual	57	35	42	35	24	58	25	39	27

Source: Forest Statistics for West Virginia 1989 and 2000, USDA Forest Service, Northeastern Research Station, Resource Bulletin NE-157 and Forest Resource Statistics for the Monongahela National Forest: 2000, USDA Forest Service, Northeastern Research Station, Resource Bulletin NE-161.

It is difficult to predict what will happen to timber size or age classes on non-federal lands within or adjacent to the MNF proclaimed boundary, but a couple of factors are worth considering. First, development for housing, industry, recreation, and agriculture is much more likely to occur at any scale on non-federal lands than on federal lands. If and when this type of development occurs on forested land, it would convert that land to a non-forested condition. This conversion may or may not affect age class diversity, but it would reduce the forested land base within the counties, and it would eliminate the potential for sustainable timber management on those lands.

Second, a portion of the non-federal lands in the cumulative effects area is owned and managed by timber industry or by private and state landowners that periodically sell timber for profit. These lands will likely continue to be managed for timber supply, with a steady or increasing amount of younger age classes over time. The timing, amount, and intensity of harvest on these lands could have an indirect effect on MNF vegetation management. For example, if private and/or state lands are heavily harvested in a watershed or Indiana bat primary range that is shared by the MNF, the Forest may choose to forego or delay harvest in the shared area in order to avoid undesired cumulative effects to age class distribution, soils, wildlife habitat, or other resources.

Forest Insects and Diseases – As noted in the *General Effects* section, native species of insects and diseases would tend to increase in unmanaged stands as they grow older and their biomass and decay increase. Whether these endemic pathogens ever reach epidemic proportions depends on many factors, some of which are unpredictable, like climatic events or even management on adjacent lands. Managed stands with younger, fast-growing trees are more resistant to stress and attacks from native insects and diseases. Thus, a patchwork of managed and unmanaged stands is likely to be less affected by endemic insects and diseases over time than large-scale contiguous stands of older trees. The pattern of federal and non-federal management on interspersed lands could play an important role on the distribution and spread of native forest insects and diseases in the future.

The effects of non-native invasive insects and diseases are even harder to predict. Unfettered by their native predators or environmental controls, these species can have significant impacts to tree mortality, age class diversity, and species composition on the Forest and well beyond. Control efforts in the past have been implemented at the regional scale, and such efforts will need to be similarly coordinated across agencies and ownerships in the future. Because these invaders are relative newcomers to this area, knowledge of their life and feeding cycles is often limited, and their control or eradication can be a long and complex process. Treatments to eradicate or limit the spread of many species have not been fully developed, and some effective biological or chemical controls are not well accepted by the public. Also, there is always potential for new species to become established, with associated adverse effects.

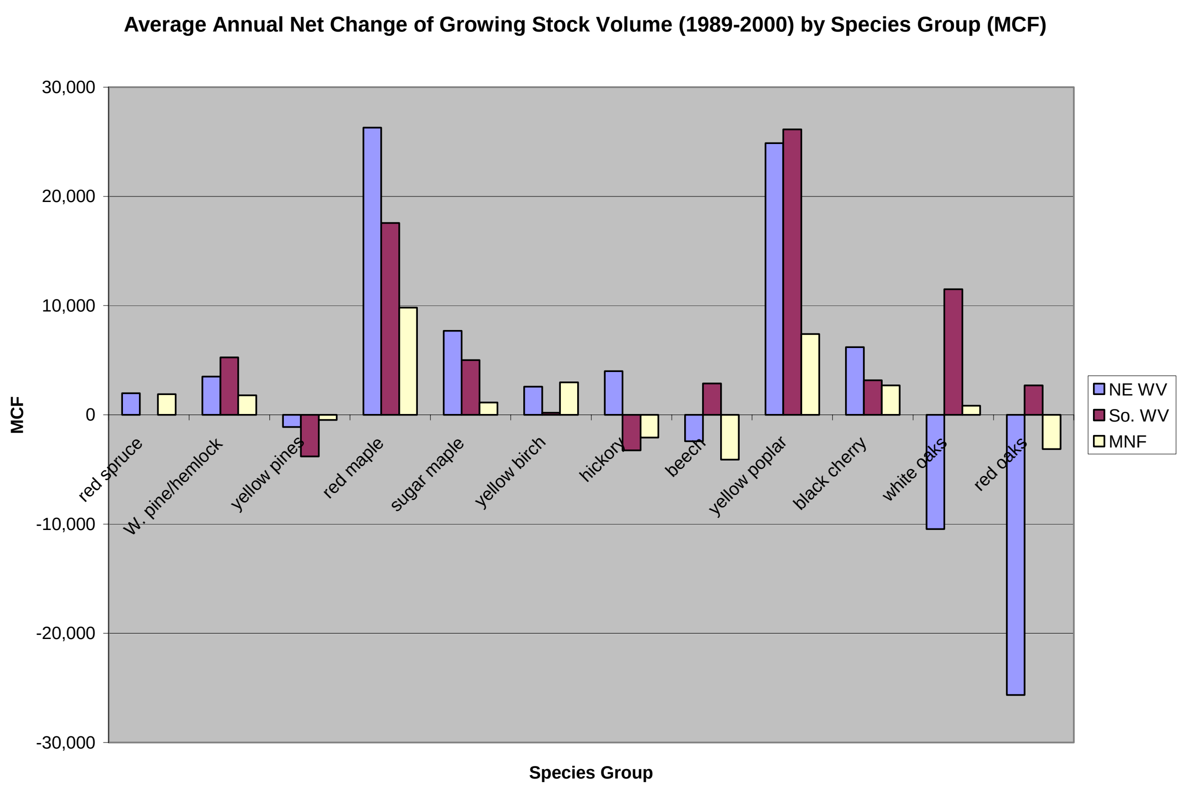
Integrated Pest Management (IPM) is the use of a variety of tools or practices to control pests and is the preferred process for developing and implementing projects on the Forest. IPM is a complex process that requires considerable research, but the end results are generally the most effective, cost efficient, and least harmful to other forest resources and non-target pests. Preventing or reducing the spread of non-native forest pathogens would be a futile effort without the cooperation of private landowners and other federal, state, and local government agencies.

The West Virginia Department of Agriculture (WVDA) and the Forest Service coordinate management efforts in the State, utilizing IPM methods, to control or eradicate pathogens on private, state, and federal lands. WVDA and the Forest Service coordinate gypsy moth detection and spray programs. Both agencies are spraying infected hemlock trees in accessible areas and releasing beetles in an effort to control the hemlock wooly adelgid. Implementing coordinated IPM techniques on the MNF and adjacent lands will help meet the challenge of this ever-increasing management concern.

Issue #2 - Vegetation Restoration

Species Composition on the MNF and West Virginia - Species composition is gradually changing on MNF lands and in West Virginia. Figure VE-2 shows the annual average growth of sawtimber volume measured in thousands of cubic feet (MCF) by species groups on timberland within West Virginia and on MNF lands. Total growing stock volume increased by 6.5 percent to 22.4 billion cubic feet in West Virginia, with the average volume per acre increasing from 1,763 cubic feet in 1989 to 1,895 cubic feet in 2000. An estimated 64 percent of the timberland on the MNF is fully stocked or over-stocked compared to 46 percent of all timberland in West Virginia. About 78 percent of forest land on the MNF is in the sawtimber size class compared to 70 percent in West Virginia.

Figure VE-2



Source: Forest Statistics for West Virginia 1989 and 2000, USDA Forest Service, Northeastern Research Station, Resource Bulletin NE-157 and Forest Resource Statistics for the Monongahela National Forest: 2000, USDA Forest Service, Northeastern Research Station, Resource Bulletin NE-161.

The northeastern and southern units (as described in the FIA analysis) shown in Figure VE-2 contain counties with MNF lands. All of the spruce/fir forest types occur in the northeast section of West Virginia in Pendleton, Pocahontas, and Randolph Counties with nearly 80 percent of red spruce growing on MNF lands.

Red maple and yellow poplar have the greatest net growth of all species. Yellow pines, hickory, beech, white oaks, and red oaks are showing declines in net growth in one or more of the three units shown above in Figure VE-2. The decline in beech is most likely due to the beech bark disease complex. The southern unit shows an increase in net growth of beech because the killing front of the disease had not reached many of the southern counties in West Virginia when these data were collected. Hemlock is not showing a decline in the figure above because the most recent data collected are from 1999 and 2000. Hemlock wooly adelgid has spread further into West Virginia in the past 5 years and mortality has increased. Hemlock will continue to decline unless a remedy is found to control or eradicate the adelgid from the eastern United States.

The cumulative effect of change in species composition is trending toward a higher percentage of red maple, sugar maple, and yellow poplar with a lower percentage of hemlock, beech, yellow pines, hickories, and oaks. This overall trend of reduced diversity, combined with larger areas of forested land not being actively managed, may result in pine-oak forest types converting to white pine or mixed hardwood and mixed oak forest types converting to mixed or northern hardwood forest types.

Prescribed Fire and Wildfire - The yellow pine, hickory, white oak, and red oak species groups are considered to be fire-adapted forest communities. The decline of these species groups seen in Figure VE-2 may, in part, be caused by successful fire suppression and control efforts. Without disturbance these species groups are not able to compete for sunlight and nutrients as well as other species like red maple and yellow poplar. Red maple grows well in the shade and the crowns block out much of the sunlight that the seedlings of shade-intolerant species need to become established. Yellow poplar simply grows more rapidly in full sunlight to maintain dominance for available sunlight. Without fire to reduce the competition for sunlight and nutrients, the fire-adapted species succumb to the shading of trees adapted to growing in the shade or to more rapidly growing tree species.

The WVDNR, MeadWestvaco Corporation, and the MNF all have conducted prescribed burns within West Virginia. Only WVDNR and MNF have annual programs, with WVDNR burning an average of 760 acres per year over the past 6 years, most of this occurring outside of the MNF proclamation boundary. The MNF has not burned more than 300 acres in any year since 1998. MeadWestvaco Corporation does not have an annual prescribed burning program but occasionally conducts burns for research studies on its Ecological Research Forest in Randolph County. If substantial annual prescribed burning program are not implemented, the cumulative effect is that fire-adapted ecosystems will continue to decline, species that grow well in the absence of fire will become more abundant, thereby decreasing diversity, while hazardous fuel loads will continue to increase. Funding levels, available trained personnel, and climatic constraints may be the most limiting factors on whether the Forest will achieve the maximum amount of prescribed burning allowed on an annual basis.

Although the potential for high-intensity wildfires is not currently high on the Forest, it is increasing in some areas because of the accumulating fuel loads resulting from an aging forest that is also seeing an increase in tree mortality from native and non-native pathogens. This situation is compounded by the fact that a once rural area is becoming increasingly populated, creating more wildland-urban interface. Many small developers have constructed homes in areas that once were contiguous forests. New homes are usually constructed in small openings surrounded by forest. Many of these developments are accessed on dead end, one-lane gravel roads, and some homes may be several miles from a main highway. Of the 167 communities located in the vicinity of federal lands in West Virginia that are listed at high risk from wildfire (Federal Register 2001), 90 are located either inside the MNF proclamation boundary or are within 5 miles of the boundary. Prescribed fire and timber harvest used for ecological restoration can also lower fuels, create fuel breaks, and reduce the potential for wildfires to damage or destroy homes and communities.

Wildfires will continue to be suppressed as they occur except possibly within wilderness areas where a wildland fire use policy may be implemented if there is no danger to life or property. Wildfire suppression is usually a cooperative effort with local fire departments, West Virginia Division of Forestry, and the MNF. Extended periods of drought would increase risk of escalating fire intensity, and could result in stand-replacement events and potential damage to resources and property. It is unknown when or where wildfires would occur or how large they would grow before they are controlled. There is no method to predict the pattern or cycle of human or lightning-caused fires for any of the alternatives. However, it is likely that wildfires will burn more intensely in periods of drought, and due to the build-up of fuel loads from the increased mortality of trees caused by an aging forest and escalating pathogens. The risk of damage to life, property, and resources will most likely continue to increase but the cumulative effects cannot be predicted to any level of certainty.

Timber Supply

INTRODUCTION

The per capita demand in the United States for wood products continues to increase in spite of increased recycling efforts and improved efficiency of wood production (USDA Forest Service 2003). Wood use efficiency in manufacturing processes increased by 41 percent from 1952 to 1998. Harvesting on National Forest System (NFS) land provided nearly 18 percent of the volume produced in 1964, but had dropped to less than 4 percent by 1998 (USDA Forest Service 2002). West Virginia is a net exporter of wood, while the United States is a net importer.

The Multiple Use-Sustained Yield Act of 1960 requires NFS land to be managed for outdoor recreation, range, timber, watershed, wildlife, and fish. The Endangered Species Act of 1973 requires that forest management provide for the protection and recovery of threatened and endangered (T&E) species and the National Forest Management Act (NFMA) of 1976 provides direction for maintaining biological diversity and habitats for native plants and animals. All of these resources should be considered when determining the long-term sustained yield of the timber resource. The NFMA also gives guidance on the maximum amount of harvesting that may occur on NFS land. Section 13 of NFMA limits the amount of harvest to a quantity that is equal to or less than that which could be removed annually in perpetuity on a sustained yield basis. The Act allows for a departure from this non-declining, even-flow concept in order to meet overall multiple-use objectives. The NFMA also requires that national forests periodically re-assess the land considered suitable for timber production and the amount of production that may occur on a regulated sustained basis. The Monongahela National Forest (MNF) is complying with the Act through the following analysis of timber suitability, allowable sale quantity (ASQ), and the harvest methods to be used in timber production.

Need For Change

Through implementation of the 1986 Forest Plan, it has become apparent that areas available for commercial timber harvest were different than originally estimated. This has resulted from the combined effects of newly acquired lands and mitigation factors such as riparian protection buffers, restrictions on recently identified listed species habitat, and limitations relating to visual quality objectives.

In addition, assumptions were made about using cable logging systems on steeper areas of the Forest. Timber operations with cable logging systems have not developed as predicted. Assumptions were also made using 200-year rotation lengths. Many hardwood tree species have an average life expectancy of less than 200 years. The Forest needs to reconsider its timber harvest options and methods in terms of how they should or should not be used to help achieve desired vegetation conditions.

Timber harvest volumes have decreased over the past 10 years, mostly due to certain species' habitat requirements that were not known in 1986, Forest reorganization, and changes in management emphasis. These changes have led to a need to revisit suitable lands determination, revise supply estimations, and recalculate ASQ based on changes to the land base, land allocation, and management direction.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect the amount of land suitable for the sustainable harvest of timber products, the amount of timber offered by the Forest, and the methods used to harvest the timber.

Background

In 1897, the Organic Act established the National Forest System to furnish a continuous supply of timber to the nation and to protect watersheds. This direction remains today. Regulations implementing the NFMA require a Regional Forester to estimate the amount of timber that can be sold annually on a sustained-yield basis. The NFMA also requires the identification of lands that are not suited for timber production.

The 1986 Forest Plan identifies the NFS lands that are suitable for timber production. As the 1986 Forest Plan has been implemented, though, some land designations made then have changed. For example, some lands previously designated as suitable for timber production have been found to support populations of T&E species. Forest Plan Amendment #6 (March, 2004) reclassified some of these lands to protect the habitat of these species. Other lands that had been classified as unsuitable for timber due to access problems are now classified as suitable because of the use of helicopter logging where fewer roads are needed. Also, trees have been growing for 19 years since the 1986 Forest Plan was signed, and this growth has added considerably to the potential timber volume on the Forest. There is an identified need to recalculate timber production for the Forest.

Timber management on the Forest is primarily influenced by the allocation of Management Prescriptions (MPs), as some areas on the Forest are assigned prescriptions that allow or emphasize timber harvest, and others are not. Some of the MPs are considered not suitable for managing timber, and some include lands that are both suitable and unsuitable. The prescriptions with suitable lands also have desired conditions for vegetation that may affect the harvest methods used to achieve them. The range of alternatives proposed in this EIS have different allocations of MPs, and can be used to show relative differences in timber production and methods based on those allocations.

Indicators

The following indicators reflect the potential relative change under each alternative based on anticipated levels of management activities that could have effects on timber supply.

- Acres of land suited and not suited for timber management by alternative,
- Potential cubic board feet of ASQ by alternative,
- Acres treated by harvest method by alternative.

Scope of the Analysis

The affected areas for direct and indirect effects to timber suitability are lands administered by the Forest. This area represents the potential lands that would or would not contribute to a sustainable and regulated timber supply from the Forest. The affected areas for ASQ are the lands classified as suitable for timber management under each alternative. The affected areas for cumulative effects on timber supply are forested lands in the counties located within the proclamation boundary of the MNF. This area includes lands administered by both the Forest and other owners. Suitability is calculated for the present, knowing that it can change on a project-by-project basis. ASQ and harvest methods are analyzed over a 100-year planning horizon, and reported for the first, fifth, and tenth decades to show trends over the long term.

CURRENT CONDITIONS

The Forest now contains over 919,000 acres within 10 counties in West Virginia. The state is 78 percent forested, making it the third most heavily forested state in the country. The Forest has 9 percent of the total timber volume in West Virginia on 7.5 percent of the forested land in the state. Annual net growth of timber volume, accounting for mortality losses, was nearly four times the average amount harvested annually between 1989 and 2000. Annual mortality on NFS land on the Forest is slightly higher than other forested land in West Virginia, most likely due to the large percentage of Forest acres that are not actively managed. Table TR-1 shows the percent of land that is forested in the counties located within the Forest proclamation boundary, the percent of MNF land in each county, and the number of acres of MNF land in each county.

Table TR-1. Forested Land and MNF Land by County, 2000

County	Acres	% Forested	% MNF	Acres MNF Land
Barbour	221,062	64	0.1	11
Grant	305,920	79	6.5	20,001
Greenbrier	654,592	75	16.5	108,084
Nicholas	420,333	80	5.6	23,540
Pendleton	446,033	82	18.3	81,801
Pocahontas	603,270	89	51.3	309,429
Preston	418,483	69	0.9	3,897
Randolph	669,658	88	30.4	203,407
Tucker	269,869	84	37.6	101,399
Webster	357,504	93	18.4	65,800
Total	**4,366,724**	**78**	**21**	**917,369**

Source of % Forested Land by County: Forest Statistics for West Virginia 1989 and 2000, USDA Forest Service, Northeastern Research Station, Resource Bulletin NE-157

Sawtimber stands make up 78 percent of the Forest, with 34 percent of the volume in valuable Grade 1 (high-quality lumber grade) trees. Other forested lands within West Virginia have an average 21 percent of the hardwood sawlog volume in Grade 1. The difference in the quality percentages is because timber stand improvement activities have been applied to thousands of acres on the Forest over the course of several decades. One of the primary purposes of these treatments has been to remove poor quality trees, leaving the higher quality trees to increase in growth and value.

Red maple is the most prevalent species on the Forest, containing 14 percent of the volume. All oak species together represent almost 24 percent of the volume. Red maple volume on the Forest comprises more than 13 percent of the State total, while Forest oak volume comprises about 14 percent of the State total. Almost 80 percent of the red spruce growing in West Virginia and 50 percent of the yellow birch is found on the Forest (Widmann and Griffith 2004).

Suitable Land Available for Timber Management

During Forest Plan revision, the Forest Service is required to identify lands tentatively unsuited for timber production [16 USC 1604(k); 36 CFR 219.14]. The amount of tentatively unsuited land does not vary by alternative because these are the lands that are considered not physically or economically capable of producing timber for the entire Forest.

During the analysis for the 1986 Forest Plan, there were an estimated 851,848 acres on the Forest, of which 723,670 acres were considered tentatively suitable for timber management. Acres that were withdrawn from tentatively suitable timber land included water, non-forested land, Wilderness, other withdrawn land, and sites that could not be managed as regulated NFS land without undue resource risk, as seen in Table TR-2.

Table TR-2. Lands Tentatively Suited for Commercial Timber Harvest, 1986 Forest Plan

Acres	Description
851,848	National Forest System lands in 1986
- 19,913	Non-forested land, including water
- 89,107	Forested land withdrawn from timber production (Wilderness, WSRs, etc.)
- 11,664	Lands not suited because restocking within 5 years cannot be assured
- 1,223	Lands not suited due to irreversible damage that could occur from timber operations
- 6,271	Lands not suited because current information is inadequate for decision-making
723,670	Tentatively suitable land for timber production

The 1986 Forest Plan contained additional acres that were withdrawn from suitable timber lands for various reasons, as shown in the table below.

Table TR-3. Lands Suited for Commercial Timber Harvest, 1986 Forest Plan

Acres	Description
723,670	Tentatively suitable land for timber production
- 60,581	Lands not appropriate for production because of environmental limitations
- 114,664	Lands not appropriate because Management Prescriptions do not include timber harvest
- 217,265	Lands not appropriate because they are the least cost-effective to achieve harvest goals
331,160	Tentatively suitable land not currently within or planned for non-timber purpose

Changes have occurred since 1986 that have affected the Forest's land suitability determination. Over 65,000 acres have been added to the Forest through land acquisition. Many of these acres were managed for timber in the recent past and were therefore considered suitable and added to the suited timber base. However, a similar amount of acres were removed from the suited base because they were identified as T&E listed species (primarily West Virginia northern flying squirrel habitat. Therefore, the current suited base (332,200 acres), as represented by the 1986 Forest Plan as amended (and Alternative 1), is considered to be roughly what it was in 1986, although those acres have shifted somewhat on the landscape due to changes described above.

Allowable Sale Quantity

The ASQ represents the maximum quantity of timber that may be harvested from the area of suitable land covered by the Forest Plan during the planning cycle. This quantity is based on modeled estimates of harvest needed to achieve desired vegetation conditions in the Plan, as tempered by specific Plan constraints. It is not intended to be an accurate prediction of annual volume produced or a volume target, as production may be affected by a number of variables, including budget, personnel, appeals, litigation, disturbance events, and shifting Forest priorities. The ASQ is generally expressed in million cubic feet (MMCF) or million board feet (MMBF) of timber volume. The timber volume available for harvest varies by alternative based primarily on the amount of suitable timber land.

Based on the capability of the land and availability for commercial timber production, the 1986 Forest Plan estimated the maximum yearly production potential of the Forest at approximately 250 MMBF per year. Considering all of the other resources that need to be managed, the Final Environmental Impact Statement for the 1986 Forest Plan analyzed six alternatives with maximum potential average annual timber production (ASQ) ranging from 40 to 50.2 MMBF in the first 10 years (1987-1996) and 75 to 177 MMBF in the fifth decade (2027-2036). The predicted ASQ for the selected alternative was 57.1 MMBF in the first decade, 57.9 in the second decade, and 60.1 in the third decade, which we about to enter.

Table TR-4 shows the volume of commercial timber sales offered, sold, and harvested for fiscal years 1987 through 2004. The volumes differ because not all volume that is offered is sold or harvested, or sold or harvested in the same year it is offered. These figures represent the volume of timber products sold through the competitive sealed bid process and removed under timber sale contracts.

Table TR-4. Commercial Timber Produced on the MNF, 1987-2005, in Million Board Feet

Fiscal Year	Volume Offered	Volume Sold	Volume Harvested
1987	34.3	30.0	36.0
1988	40.1	36.0	50.7
1989	40.5	39.0	36.9
1990	39.1	34.0	28.3
1991	39.0	39.0	36.4
1992	38.7	35.4	36.6
1993	30.0	30.0	33.5
1994	32.8	26.7	20.9
1995	29.7	25.6	22.1
1996	15.2	12.2	28.3
1997	17.0	12.7	25.2
1998	14.6	9.9	24.5
1999	0.9	9.6	24.2
2000	15.2	3.9	13.9
2001	13.9	13.2	7.5
2002	2.0	12.8	7.8
2003	0.9	2.1	11.7
2004	1.1	2.1	9.0
2005	12.6	8.4	8.2

The 1986 Forest Plan calculated ASQ for the first decade and expressed it as average annual harvest volume. When the 1986 Forest Plan was signed, many people considered ASQ to be the volume target for the Forest. From 1996 through 2004, the Forest with the Regional Office negotiated volume targets. The dramatic decline in timber volume offered and sold beginning in 1993 was in part due to Forest reorganizations based on expected budget cuts and changes in management emphasis. The reorganizations combined district offices and reduced the number of positions on the Forest, especially in the forestry and engineering job categories. The more recent decline in timber volume offered and sold was due to Forest Plan Amendment 6 dealing with threatened and endangered species. Since the 2004 Amendment, the volumes offered, sold, and harvested have begun to rise again.

Timber Market in West Virginia and Local Counties

Although the volume offered and sold continued to decline, timber prices increased more than six-fold from 1987 through 1993 and have remained fairly constant since then with a few exceptions. Leading the increases in value were sugar maple, yellow poplar, red oak and especially black cherry prices.

With over 350 businesses producing wood products, the wood industry in West Virginia employs more than 30,000 people and generates an estimated $3.2 billion to the state's economy (http://www.forestry.com/indassistance.cfm?menucall=industry; accessed June 9, 2005). During the past inventory period, annual growth of timber was estimated at 430.4 MMCF, while annual removal from timber sales averaged 247.9 MMCF for the State. The ratio of growth to removal is approximately 1.7:1, which means West Virginia is growing nearly twice the amount of wood than it is cutting (USDA Forest Service 2003).

Table TR-5 below shows the volume of timber products from counties within the proclamation boundary of the Forest in 1996 by land ownership. This year was chosen to display because it represented the approximate average of volume harvested over the period from 1986 to present. Overall in 1996, 13 percent of the wood harvested in these counties came from Monongahela NFS lands. The volume of roundwood products for West Virginia in 1996 was estimated at 169.6 MMCF. Thus, the 10-county area produced about 39 percent of the volume for the State. Only about 5 percent of the State's volume came from NFS lands within the 10 counties.

Table TR-5. Volume Harvested (MMCF) of Products by County and Ownership in 1996

County	% NF	Volume Harvested (MMCF)								
		NFS Land	% Total	Other Public	% Total	Forest Industry	% Total	Other Private	% Total	All Owners
Grant	6.5	0	0%	0	0%	0	0%	1.8	100%	1.9
Greenbrier	16.5	0.9	6%	0.3	2%	6.8	49%	5.9	43%	13.8
Nicholas	5.6	0	0%	0	0%	2.9	21%	10.7	79%	13.5
Pendleton	18.3	0.9	37%	0	0%	0	0%	1.5	63%	2.4
Pocahontas	51.3	3.4	75%	0	0%	0	0%	1.1	25%	4.5
Preston	0.9	0	0%	0.2	4%	0	0%	5.4	96%	5.6
Randolph	30.4	0.5	4%	0	0%	1.6	14%	8.9	82%	10.9
Tucker	37.6	1.1	34%	0	0%	0	0%	2.2	66%	3.3
Webster	18.4	1.9	20%	0	0%	5.4	57%	2.2	23%	9.5
All Counties		8.7	13%	0.5	1%	16.6	24%	39.7	62%	65.4

Source: http://srsfia2.fs.fed.us/php/tpo2/tpo.php

Wood harvest for industrial uses in West Virginia totaled 202 MMCF in 2000, an increase of nearly 22 percent compared to 1994. However, this was a smaller increase than recorded from 1987 to 1994 of 38 percent. Overall the production of pulpwood roundwood increased 30 percent in 2001 compared to 1994 (Hansen et al. 2006).

Table TR-6 shows the amount of timberland in the State of West Virginia by ownership, indicating that federal lands have a relatively small proportion of timberland within the State.

Table TR-6. Area of Timberland in West Virginia by Ownership, 2000

Ownership	Acres	Percent
National Forest	980,200	8.3
Other federal	107,000	0.9
State	164,800	1.4
County/municipal	59,600	0.5
Inter-governmental	17,400	0.1
State Forest	73,400	0.6
Forest Industry	1,094,800	9.3
Farmer	607,600	5.2
Miscellaneous Corporate	2,134,800	18.1
Miscellaneous Individual	6,162,000	52.2
Miscellaneous Other	395,400	3.4
Totals	11,797,000	100.0

Source: USDA Forest Service Northeastern Research Station Resource Bulletin NE-157

Table TR-7 shows the number of wood using industries in counties with Monongahela NFS lands, as well as the types of products these industries produce.

Table TR-7. Number of Wood Using Industries by County

County	Number of Industries	Types of Products
Barbour	13	Lumber, Ties, Cants, Cabinets, Rails, Posts, Moulding, Flooring, Furniture, Pews
Grant	5	Lumber, Ties, Cants, Moulding, Firewood, Mulch, Baskets, Dimension Pieces
Greenbrier	4	Lumber, Cants, Architectural Woodworking
Nicholas	14	Lumber, Cants, Furniture, Veneer, Cabinets, Moulding, Siding, Panels, Flooring, Pallets, Boxes, Posts, Rails, Trim, Doors, Stairs
Pendleton	2	Lumber, Ties, Log Cabin Parts
Pocahontas	11	Lumber, Cants, Posts, Rails, Firewood, Pulpwood, Log Homes, Paneling, Furniture, Crafts, Framing
Preston	9	Lumber, Cants, Ties, Moulding, Paneling, Framing, Flooring, Pallets, Crates
Randolph	26	Lumber, Cants, Posts, Rails, Flooring, Furniture, Cabinets, Firewood, Doors, Toys, Pulpwood, Moulding, Paneling, Trim, Frames, Plaques, Picnic Tables, Signs, Stairs, Stakes, Clocks, Casing, Handle Blanks, Mantles, Windows, Benches, Swings
Tucker	3	Lumber, Architectural Woodwork, Posts, Rails, Ties
Webster	9	Lumber, Cants, Ties, Posts, Rails, Pallets, Paneling, Flooring, Siding

Source http://www.wvforestry.com/indassistance.cfm, accessed March 9, 2004

Since the existing 1986 Forest Plan was signed, two Oriented Strand Board (OSB) mills (in Braxton and Fayette Counties) and one major hardwood-flooring mill (Randolph County) have opened within hauling distance of MNF lands. The two OSB mills utilize nearly 1.5 million tons of soft hardwood fiber annually. Generally, these mills will bring in material from distances up to 150 miles for processing. The hardwood-flooring mill utilizes about 1.75 MMBF per week of mostly oak lumber. Two other mills utilizing yellow poplar, cucumber tree, and sycamore also began operations in the 1990s, with the capacity to use 100 MMBF annually. These five new mills directly created over 1,000 new jobs in West Virginia. In the early 1990s, the Mead

Westvaco paper mill in Covington, Virginia added another paper machine that nearly doubled their previous capacity (from 1.6 million tons of wood fiber to 3.0 million tons). Much of the pulpwood harvested from Forest timber sales goes to nearby Mead Westvaco paper mills. Pulpwood volume has represented only about 20 percent of total volume harvested on the Forest and has been typically low value material. Many of the existing sawmills have increased their wood use capacity by adding a work shift. A few other sawmill companies have constructed additional sawmills within West Virginia or have increased production by improving technology.

In 1986, about 400-500 MMBF of timber was harvested in West Virginia. In 2003, about 1,000 MMBF was harvested (personal communication on 3/17/04 with Ed Murriner, Assistant State Forester). From 1999-2003 the MNF sold 22 sales to 11 different purchasers. Six of the purchasers were located within the Forest Proclamation Boundary, three purchasers were within 15 miles of the boundary, and the other two purchasers had timber processed within the Proclamation Boundary.

Management Prescriptions/Silviculture Systems/Harvest Methods

Each Management Prescription (MP) describes the amount and type of activities that may occur in that area. The amount and/or type of activities that may occur, such as timber harvest, prescribed burning, wildlife habitat improvements, etc. will be defined in the desired condition, goals, objectives, standards, and guidelines and in each MP. As MPs vary in the mix and amount of treatments or lack of treatments, they provide a good comparison between alternatives.

The selection of which silvicultural system and harvest method to use on these lands is based primarily on the site, the existing condition of the forested stand, and the desired condition and objectives of the MP.

A variety of silvicultural tools are available for vegetation treatments to provide a variety of habitats and products. These tools include timber stand improvement cuts (both commercial and non-commercial), regeneration cuts, planting, herbicides, and prescribed fire, all of which can influence the stand complexity of the understory, midstory, and overstory layers of the forest. In addition, systems used to harvest timber can vary from rubber tire skidders to cable yarders and horses to helicopters.

The 1986 and 2006 Forest Plans allocate land to specific MPs, each with certain desired conditions and associated outputs. Each MP has a primary emphasis that guides the management of forest resources in the area. Active management (commercial and non-commercial timber harvest) of forest types and age classes occurs in MPs 2.0, 3.0, 4.0, 4.1, and 6.1 at various intensities and for differing reasons. The following are goals for MPs that allow active vegetation management:

MP 2.0 - The purposes for lands assigned MP 2.0 are to emphasize a continuous forested scene and shade-tolerant vegetation. Shade-tolerant vegetation will be managed by uneven-aged silvicultural actions (1986 Forest Plan, Chapter IV).

MP 3.0 - MP 3.0 lands will emphasize large, high quality hardwood trees for lumber and veneer, hard mast, and scenic attributes. The forest will be a mosaic of stands of predominately hardwood trees and associated understories with variety in size, shape, and height of tree species depending on the silvicultural system applied (1986 Forest Plan, Chapter IV).

MP 4.0 - Lands assigned MP 4.0 will emphasize a variety of coniferous species managed for fiber and lumber. This MP includes existing conifer stands, with some associated hardwoods (1986 Forest Plan, Chapter IV).

MP 4.1 - The MP 4.1 emphasizes the active and passive restoration of spruce and spruce-hardwood communities and the recovery of species of concern found in these communities, a mix of forest products, management of hardwood communities where spruce is not present or represents only a minor component of a stand, and research or administrative studies on spruce restoration. Passive management and research or administrative studies only would be allowed on lands determined to be suitable habitat for the WVNFS (2006 Forest Plan, Chapter III).

MP 6.1 - The primary purpose of lands assigned to MP 6.1 is to provide habitat for wildlife species that prefer remote habitat. Most roads remain closed to public vehicle traffic through most of the year. A mixture of forest products is a secondary goal to assist in the management of wildlife habitat. Since hard mast is to be emphasized in these areas, sites reverting from hardwood to conifer (pine and spruce) are to be managed to ensure long-term continuous hard mast production by providing a variety of age classes (1986 Forest Plan, Chapter IV).

The silvicultural system defines the treatment to regenerate (or prepare for a regeneration cut) a forested stand of trees using a particular harvest method. Each system is formulated and designed for a specific set of circumstances, objectives, or environmental conditions yet is dynamic to allow flexibility as situations or scientific knowledge changes. The basic conditions to consider when choosing a silvicultural system include:

- Characteristics of the tree species and forest types.
- Features of the site(s) where the trees are growing.
- Protection or enhancement of other resources such as wildlife, water, soils, etc.
- Goals and objectives for the area.

The characteristic of the tree species or forest type (such as tolerance to shade, susceptibility to wind throw, adaptability to soil and moisture conditions, and vulnerability to insects, disease, and fire) determines the range of alternative treatments that can be prescribed. For example, a plant species needing full sunlight will not grow well under the shade of closed forest canopy, or a tree species with a shallow root system should not be regenerated with the seed tree harvest method because the seed trees might blow over before a new stand can become established. Generally, there are two silvicultural systems that have been used to manage the MNF: 1) even-aged and 2) uneven-aged.

Even-Aged Silvicultural System

This system is designed to create a forested stand where all the trees are about the same age or where the difference in age from the oldest tree to the youngest tree does not exceed 20 percent of the length of the rotation. The length of the rotation is the time when a stand of trees is mostly in the seedling stage (or immediately after a regeneration harvest) to the time when the stand is ready for a regeneration harvest. For example, in a recently regenerated stand with a 100-year rotation, most of the youngest trees would have an age between 0 and 1 while most of the oldest trees should be no older than 20. When most of these trees reach 100 years of age, the stand is again ready to be regenerated. In a regulated forest, this system is designed to create or maintain individual stands that collectively should produce a diverse pattern of age classes across the landscape over time. The purpose of this system is to regenerate tree species generally intolerant or moderately tolerant of shade for a sustainable supply of forest products. Harvest methods in the even-aged silvicultural system include:

- Clearcutting with reserve trees,
- Two-aged,
- Shelterwood,
- Seed tree, and
- Thinning.

The even-aged system tends to mimic moderate to major disturbance events found in nature such as uncontrolled wild fires during periods of drought, hurricanes, tornadoes, ice storms, or insect/disease outbreaks, but in a more controlled manner. The intent is to open the forest floor to more sunlight so trees that need full or partial sunlight (shade intolerant) can grow. These methods require fewer harvest removal entries into a stand (at least 1 but usually no more than 4 within a 100 to 120 year rotation) to increase the growth or regenerate the desired species. The size of a single even-aged regeneration-cutting unit has been limited to 25 acres in the 1986 Forest Plan, although the NFMA allows a 40-acre size limit for hardwood forest types. The 25-acre limit has been removed in the 2006 Forest Plan, and the limit would default to 40 acres to be consistent with the NFMA. Exceptions to exceed the NFMA size limit need the approval of the Regional Forester.

The **clearcutting with reserve tree method** harvests nearly all of the trees within a stand in one removal. Typically some trees are left to meet wildlife habitat or other resource needs. This method requires fewer entries, is less costly to administer, and is considered to be the most economically efficient (over the long term) of all harvest methods.

The **two-aged method** harvests most of the trees in the older age class to create a young age class. Harvest entries are usually scheduled 40 to 80 years apart to maintain two distinct age classes within the stand. The residual basal area in a two-age harvest should be from 15-25 square feet of basal area per acre. The lower residual basal area is necessary due to the length of time to the next entry to allow the intolerant and moderately tolerant species to grow into the canopy before the residual crowns close and suppress the growth of the regeneration.

The **shelterwood method** harvests the mature trees in two or more removal cuts within 3 to 20 years after the initial cut. The shelterwood method requires a re-entry harvest usually within 3 to 20 years after the first entry allowing a higher residual basal area of 30 to 50 square feet per acre. The longer the time between the initial entry and the second entry, the lower the residual basal area should be. Both the two-aged method and the shelterwood method are preferred in hardwood stands where potential advance regeneration is lacking or absent.

The **seed tree method** is usually used in conifer stands with the first cut removing all but 2 to 10 trees/acre of the best growing, seed-producing trees of the desired species to be regenerated. A second cut to remove the seed trees may be done once an adequate number of the desired seedlings have been established.

The **thinning method** is an intermediate cut that prepares a stand for a regeneration harvest. This method removes high risk (trees that most likely will not survive until the regeneration harvest is initiated), low quality, diseased, and over mature trees to increase the health, development, and growth of the residual trees in a stand. One to several intermediate cuts may be applied in a stand prior to the regeneration harvest. Thinning is applicable to all of the forest types found on the Forest.

Uneven-Aged Silvicultural System

This system is designed to maintain a high forest canopy cover of trees that have a range of diameter, size, and age classes while continuously regenerating desirable species. A stand is considered to be uneven-aged if three or more age classes are present. The purpose of this system is to regenerate desirable tree species that grow better under the shade of the forest canopy. It is often used to maintain or enhance the aesthetic values of a forested area or provide habitat for specific wildlife species.

Harvest methods in the uneven-aged silvicultural system include singletree selection and group selection. This system tends to mimic disturbance events found in nature such as individual trees or small groups of trees dying from a weather, insect, disease, or age-related event. These events favor the regeneration of those trees that grow better underneath other trees (shade tolerant). Both harvest methods in this system require frequent entries into the stand (usually once every 10 to 20 years) to encourage continuous regeneration and growth of desired tree species. The **singletree selection method** harvests individual trees, both large and small, favoring trees such as beech and sugar maple that are tolerant of the shade of the residual forest canopy. The **group selection method** removes all trees within a small area, generally at least a half acre but typically no larger than two acres, within the larger forested stand. This method allows for the growth of some of the more shade-intolerant trees species within the uneven-aged stand.

Harvest Method Application and History

Each MP emphasizes distinct goals, objectives, and desired conditions for managing a defined area of Monongahela NFS land. The harvest method describes the treatment a stand(s) will receive based on site-specific conditions in order to attain a desired condition within a MP. For example, if a stand has an understory of striped maple with an overstory dominated by oaks and the management emphasis of the MP is to restore the oak-hickory community, then a clearcut may be the chosen harvest method since striped maple grows best under the partial shade that would be the result of a shelterwood or two-age harvest. In the partial shade of a two-age or shelterwood harvest the oaks that are moderately tolerant to intolerant of shade would not grow as quickly because of reduced sunlight caused by the shading of the residual trees and would have difficulty competing with or outgrowing the striped maple. Within 15 years after the initial regeneration harvest, most of the oaks would die because of the lack of sunlight produced by the dense shade of the striped maple trees.

The harvest method is an important silvicultural treatment that can be used to regenerate mature stands of trees that are usually in the mid- or late successional stage to the early successional stage. The early successional stage that is the result of even-aged regeneration harvest methods (clearcut, two-age, and shelterwood) provides unique habitat and food sources that are not available or available in lower quantities in the later successional stages. A specific harvest method may be chosen to increase the growth or quality of trees, enhance scenery management such as creating vistas, improve diversity of species composition, reduce the risk of fire, or minimize the risk of insect or disease outbreaks. Table TR-8 shows the timber harvest activity on the Forest from 1986 through 2003 (18 years).

Table TR-8. Acres Treated by Harvest Method on the MNF, 1986-2003

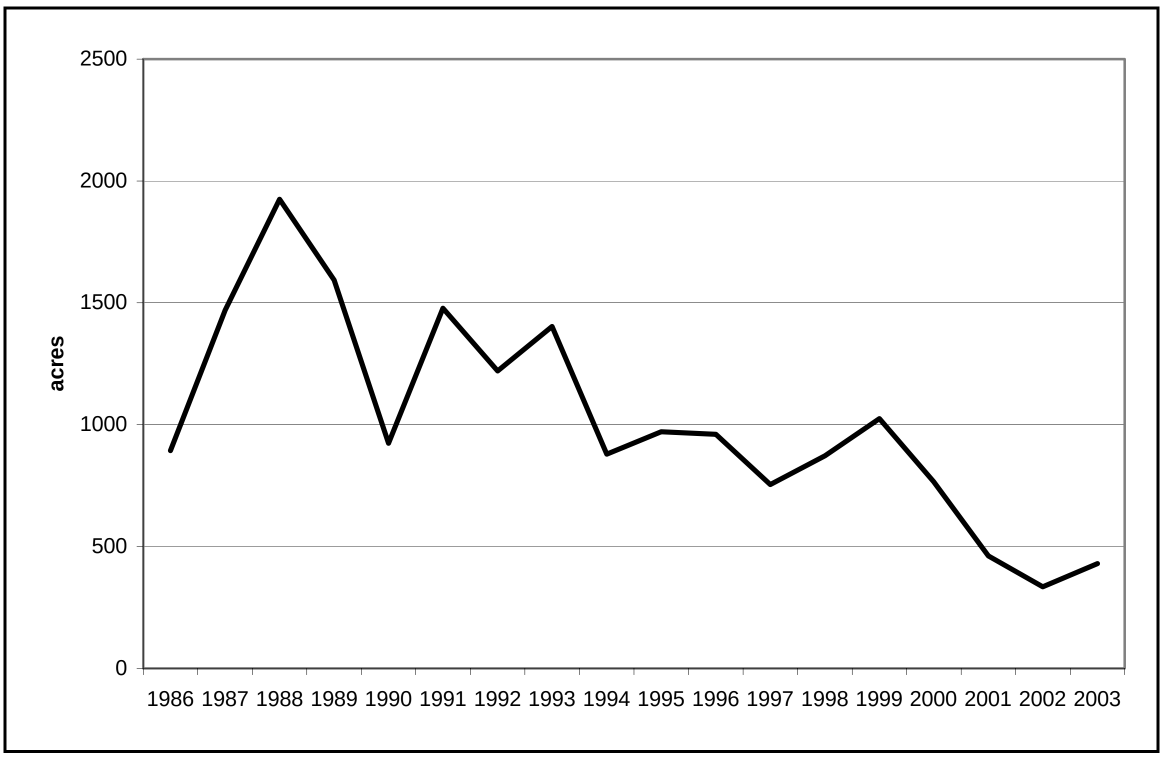
Fiscal Year	Harvest Method				
	Clearing	Even Aged	Intermediate	Uneven Aged	Annual Totals
1986	0	894	3,455	124	4,473
1987	0	1,469	3,963	273	5,706
1988	6	1,925	4,440	433	6,803
1989	0	1,593	2,459	239	4,291
1990	0	924	3,392	356	4,672
1991	35	1,457	3,133	879	5,503
1992	72	1,221	2,515	944	4,752
1993	28	1,400	1,686	27	3,141
1994	15	879	1,502	0	2,396
1995	83	971	1,631	164	2,849
1996	25	960	1,899	641	3,525
1997	58	755	1,529	405	2,747
1998	22	873	1,511	174	2,580
1999	33	1,025	1,421	351	2,830
2000	94	766	659	0	1,519
2001	4	462	534	79	1,079
2002	27	335	502	0	864
2003	41	514	741	14	1,310
Harvest Totals	**543**	**18,423**	**36,972**	**5,104**	**61,041**

There were an estimated 18,423 acres of even-aged harvest (clearcuts with reserve trees, two-aged cuts, shelterwoods), or about 30 percent of the total harvests. There were 14,129 acres of clearcuts with reserve trees, or about 23 percent of the total harvest. The 1986 Forest Plan predicted 16,000 acres (an average of 1,600 acres per year) would be regenerated by the clearcut harvest method in the first 10 years of the 1986 Forest Plan. For the first decade of the 1986 Forest Plan, 11,720 acres were clearcut (4,280 acres less than predicted). Even with the two-aged harvested acres included, the total acres regenerated by these two methods in the first 10 years of the 1986 Forest Plan were 12,181 acres. Before 1991 the two-aged harvest method was not used on the Forest. The 1986 Forest Plan does allow for this method of harvest, but it was then called the deferred rotation harvest method. The two-aged harvest method is similar to a clearcut with reserve trees except more trees are left standing.

The projection from the 1986 Forest Plan predicted 2,000 acres (an average of 200 acres per year) would be regenerated by the shelterwood harvest method in the first 10 years of the 1986 Forest Plan. A total of 1,432 acres were regenerated in 18 years by the shelterwood and seed tree methods (576 acres in the first 10 years). The even-aged harvest numbers for the second decade thus far have seen a much sharper decrease in reality over proposed.

One of the main implications of this discrepancy between predicted and actual regeneration harvests is that more of the Forest has remained in the same age class. Only about 3 to 4 percent of the Forest is now in a young, or early successional age class, and most of the Forest is mature timber in the mid or mid-to-late successional age classes. Without additional regeneration soon, most of the Forest stands will become over-mature or late successional over the next 50 years, with associated effects to age class and habitat diversity.

Figure TR-1 - Total Acres Regenerated by All Even-Aged Methods 1986-2003
All Management Prescriptions



ENVIRONMENTAL CONSEQUENCES

Resource Protection Needs

Resource protection has been integrated into timber management direction at various scales, from national to site-specific. The cumulative positive effect of the multi-dimensional direction described below is beneficial protection and mitigation for all resources that may potentially be adversely affected by timber management activities.

Laws, Regulations, and Policies

Numerous, laws, regulations, and policies govern the management of timber resources on NFS lands. National laws and regulations have also been interpreted for implementation in Forest Service Manuals, Handbooks, and Regional Guides. All timber management activities and the assessment of lands suitable for managing timber must comply with these laws, regulations, and policies, which are intended to provide general guidance for the implementation of timber management practices, and for protection of related resources. Some of the more important laws and regulations influencing timber management are listed in Table VE-5 in the *Vegetation Management* section.

Forest Plan Direction

Forest Plan management direction for timber resources has been developed to enhance, maintain, or restore forest vegetation to desired conditions on NFS lands. Direction occurs at both the Forest-wide and MP levels. Goals and objectives have been designed to provide sustainable levels of timber production, while maintaining, enhancing, or restoring ecosystem functions and processes. Standards and guidelines have been designed to protect other resources that could be adversely affected by timber management activities. Some 1986 Forest Plan direction has been removed, such as direction that repeated existing law or policy, conflicting direction with other resources, or direction that was no longer applicable due to changing conditions. Management direction for other resource programs was developed in an integrated manner to provide additional guidance for resource protection.

Forest Plan Implementation

Proper timber management depends on current and site-specific information about environmental conditions and the effects that these activities may have on other resources. Some of these conditions are not appropriately addressed at the programmatic level of the Forest Plan. Detailed silvicultural prescriptions, written and approved prior to implementation of individual projects, are designed to address the current and site-specific resource conditions. Through the project implementation process, adjustments are made to address resource concerns in a timely, effective, and site-specific manner. Additionally, during project planning, site-specific evaluations are conducted to verify the suitability classification of NFS timberlands within the project area. Appropriate site-specific mitigations from the project planning documentation are then incorporated into implementation guides and contract specifications that are applied and administered by Forest personnel and contractors.

Forested Land Identified as Tentatively Suitable for Timber Management

NFS lands are periodically assessed to determine whether they are suited for timber management. The analysis begins by identifying those lands that are not available and capable of being managed for timber production. This specifically results in identifying:

- National Forest System lands that do not or cannot support forested vegetation,
- Lands that have been formally withdrawn from timber production, such as designated Wilderness,
- Forested lands where restocking of tree seedlings cannot be assured within five years following final timber harvest, and
- Lands where timber production may result in irreversible resource damage to soil productivity or watershed conditions.

Lands that possess any one of the above conditions are classified as not suited for timber production. The remaining lands are classified as tentatively suited for timber production. These lands are potentially available for, and biologically and physically capable of timber production. This classification is the same for all alternatives, or in other words, the area identified as capable and available for timber production does not vary by alternative.

The assessment of tentatively suited timberlands for the revision of the Forest Plan has yielded the following information, summarized in Table TR-9.

Table TR-9 – Lands Tentatively Suited for Commercial Timber Harvest

Acres	Description
916,968	Legal acreage of Monongahela national Forest (Lands Program)
- 15,869	Land not forested, less than 10% stocking (CDS, LSC 204, 250, 255, 257, and 268)
- 2,856	Land not forested, water (from CDS, LSC 165, 170, and 180, and GIS STANDs 998)
- 763	Land not forested, administrative sites (office site, campgrounds, etc. from CDS, LSC 295)
- 476	Lands not forested, roads or rights of way greater than 120 feet wide (CDS, LSC 290)
- 38,023	Technology is not available to harvest without damage (CDS, LSC 720, 730, and 740)
- 8,934	Adequate regeneration cannot be assured within 5 years (CDS, LSC 710)
- 78,499	Land withdrawn from timber production, Wilderness (CDS, LSC 300)
- 6,371	Land withdrawn from timber production, Research Natural Areas, Scenic Areas, Botanical Areas, Zoological Areas, Fernow Experimental Forest (CDS, LSC 735, 802, 803, 805)
- 4,737	Difference between acres with no LSC and STANDs 998
- 2,847	Difference between legal acreage of Forest and acres in GIS
757,593	Land tentatively suitable for timber production

Lands classified as tentatively suited for timber production are further evaluated to determine whether they are appropriate for timber production. The tentatively suited timberlands identified as being appropriate for timber production are classified as suited timberlands. This will be discussed in greater detail below.

Direct and Indirect Effects by Alternative

Suitable Land Available for Timber Management

In Alternative 1, the forested acres considered suited for timber management are located in MPs 2.0, 3.0, 4.0, and 6.1. In Alternatives 2 through 4 these MPs shift to 3.0, 4.1, and 6.1. Most of the lands in MP 4.1 that are in suitable habitat for the endangered West Virginia northern flying squirrel (WVNFS) are not suitable for timber management and will not be actively managed except for research or administrative study purposes. Those lands in MP 4.1 that are not in WVNFS suitable habitat but have a spruce component, may be actively managed for restoration of the spruce-hardwood community, but are not considered as suitable for timber management. Only those stands that do not have a spruce component in MP 4.1 are considered to be suitable for timber management. Table TR-10 breaks out the tentatively suitable acres into categories that are considered not suited for timber management by MP. Many of the constraint categories were combined to show collective acres in order to avoid double-counting acres where two or more of the areas overlap.

Table TR-10 – Lands Suited and Available for Commercial Timber Harvest

<table>
<tr><th rowspan="2">Land Class Description</th><th colspan="5">Acres</th></tr>
<tr><th>Alt. 1</th><th>Alt. 2</th><th>Alt. 2M</th><th>Alt. 3</th><th>Alt. 4</th></tr>
<tr><td>Total modeled acres</td><td>912,516</td><td>912,516</td><td>912,516</td><td>912,516</td><td>912,516</td></tr>
<tr><td>Wilderness (MP 5.0)</td><td>-78,738</td><td>-78,738</td><td>-78,738</td><td>-78,738</td><td>-78,738</td></tr>
<tr><td>Recommended Wilderness (MP 5.1)</td><td>-0</td><td>-27,657</td><td>-27,657</td><td>-99,148</td><td>-0</td></tr>
<tr><td>Backcountry Recreation (MP 6.2)</td><td>-124,125</td><td>-95,993</td><td>-105,223</td><td>-222,854</td><td>-49,716</td></tr>
<tr><td>Special Areas (MP 8.0)</td><td>-115,979</td><td>-69,920</td><td>-72,820</td><td>-57,746</td><td>-69,920</td></tr>
<tr><td>Indiana Bat Primary Range in MPs 3.0, 4.1, 6.1</td><td>-0</td><td>-148,061</td><td>-146,064</td><td>-92,971</td><td>-164,521</td></tr>
<tr><td>Tentatively unsuitable</td><td rowspan="7">-261,464</td><td rowspan="7">-161,852</td><td rowspan="7">-152,629</td><td rowspan="7">-107,693</td><td rowspan="7">-202,875</td></tr>
<tr><td>WV Northern Flying Squirrel Suitable Habitat*</td></tr>
<tr><td>Eligible Wild or Scenic WSR Corridors**</td></tr>
<tr><td>Indiana Bat Key Areas and Hibernacula***</td></tr>
<tr><td>Very High and Distinct Scenic Integrity Areas</td></tr>
<tr><td>Perennial & Intermittent Stream Channel Buffers</td></tr>
<tr><td>Existing suitable base adjustment****</td></tr>
<tr><td>Suited Timberland Available for Harvest</td><td>332,200</td><td>330,300</td><td>329,400</td><td>253,400</td><td>346,700</td></tr>
<tr><td>Percent of Forest Land Base</td><td>36%</td><td>36%</td><td>36%</td><td>28%</td><td>38%</td></tr>
</table>

*In Alternative 1, WV northern flying squirrel suitable habitat is in Opportunity Area 832, part of MP 8.0
**Includes all rivers in Alternative 1, but only Wild or Scenic classification rivers in Alternatives 2, 3 and 4
***Calculated for Alternative 1, but incorporated into Indiana bat primary range for Alternatives 2, 3, and 4
****Includes adjustments in Alternative 1 for land acquisition and exchanges, and removal of the “floating” timber base referred to in 1986 but never clearly identified on the ground

The suitable acres have also been calculated for each suitable MP by alternative in Table TR-11.

Table TR-11. Suitable Acres by Management Prescription by Alternative

MP	Alternative 1		Alternative 2		Alternative 2M		Alternative 3		Alternative 4	
	Acres	Percent of MP	Acres	Percent of MP	Acres	Percent of MP	Acres	Percent of MP	Acres	Percent of MP
2.0	6,334	46%	0	0	0	0	0	0	0	0
3.0	80,723	59%	155,735	79%	154,356	79%	146,220	80%	156,555	77%
4.0	261	65%	0	0	0	0	0	0	0	0
4.1	0	0	25,726	17%	27,295	18%	22,747	25%	29,506	15%
6.1	174,648	61%	148,834	52%	147,735	53%	84,400	47%	160,685	52%
6.3	70,236	52%	0	0	0	0	0	0	0	0

For all alternatives, the suitable lands represent the areas where commercial timber harvest and associated activities are most likely to occur. However, the acres identified above are best estimates based on current knowledge, and site-specific information is used to determine suitability on a project-by-project basis.

Under all alternatives, it is highly unlikely that all of the acres considered suitable for timber management would receive harvest treatments over the next 100 years. Some areas may end up being reclassified as not suited for reasons described above. Also, management direction provides restrictions that govern the amount of management that can occur in a specific area over a given period of time. For example, Forest-wide Timber Standard TR06 states:

> No more than 20 percent of NFS lands within each prescription area unit shall receive regeneration harvest over a 10-year period.

In addition, Standard 4118 in MP 4.1 and Standard 6122 in MP 6.1 state:

> No more than 40 percent of forested NFS lands within each 6.1 prescription area unit shall be harvested over a 10-year period. Thus, at least 60 percent of each unit shall provide security areas for wildlife during the 10-year period.

Some of the factors that influenced the differences in suitable acres in this assessment are described below by alternative.

Alternative 1 - Alternative 1 has approximately the same amount of acres suitable for timber harvest as depicted in the 1986 Forest Plan, 332,200 acres. This amount represents about 36 percent of the Forest, leaving 64 percent of the Forest in areas not actively managed for timber. In this alternative only the key areas and hibernacula of Indiana bat habitat are considered not suited for timber management; as opposed to the entire primary range. Suitable habitat for the WFNFS is removed from the suited base as Opportunity Area 832, part of MP 8.0.

Alternative 2 - Alternative 2 also has about 36 percent of the total Forest acres in lands suitable for timber harvest, although 1,900 less acres than Alternative 1. MPs 3.0 and 6.1 contain the majority of lands suitable for timber harvest. MPs 2.0 and 4.0, which existed in Alternative 1, have been incorporated into other MPs in Alternatives 2, 2M, 3, and 4. In MP 4.1, only 25,700 acres (17 percent) are considered suitable for timber harvest because they do not have a spruce component, and timber management would likely have no adverse impact on the WVNFS.

Alternative 2 Modified - Alternative 2M also has about 36 percent of the total Forest acres in lands suitable for timber harvest, although 2,800 fewer acres than Alternative 1, and 900 fewer than Alternative 2. MPs 3.0 and 6.1 contain the majority of lands suitable for timber harvest. In MP 4.1, only 27,300 acres (18 percent) are considered suitable for timber harvest because they do not have a spruce component, and timber management would likely have no adverse impact on the WVNFS.

Alternative 3 - Alternative 3 has about 28 percent of the total Forest acres in lands suitable for timber harvest, leaving at least 72 percent of the area that would not be actively managed for timber. Alternative 3 is similar to Alternatives 2 and 4 in that MPs 3.0 and 6.1 contain the majority of lands suitable for timber harvest. In MP 4.1, only about 22,700 acres (25 percent) are considered to be suitable for timber harvest. The percentage of acres is higher in this alternative because the total acres in MP 4.1 are lower. This is because a large amount of the acres that are considered to be suitable habitat for the WVNFS are in MPs such as 5.1 and 6.2 where commercial timber production is restricted.

Alternative 4 - Alternative 4 has about 38 percent of the total Forest acres in lands suitable for timber harvest and has more acres in MPs 3.0 and 6.1 than any of the other alternatives. At least 62 percent of the Forest is considered not suited for timber management in this alternative. Alternative 4 is similar to Alternatives 2 and 3 in that MPs 3.0 and 6.1 contain the majority of lands suitable for timber harvest. Only about 29,500 acres (15 percent) in MP 4.1 are considered to be suitable for timber harvest. Alternative 4 has the largest amount of acres in MP 4.1 because it does not have any acres in MP 5.1 and has the fewest acres of all alternatives in MP 6.2.

Allowable Sale Quantity

Table TR-12 displays the projected maximum annual timber harvest volume for each alternative during the first, fifth, and tenth decades in order to show both short- and long-term effects. The volume projections are based on growth and yield estimates from the Spectrum computer model. Spectrum is a linear program-based model used on NFS lands, for planning purposes, to schedule outputs over a specified period of time (see Appendix B for more information on how Spectrum was used in this analysis). These estimates have not been adjusted to consider projected budget or personnel needed to plan, analyze, and implement projects to achieve these potential outputs.

Table TR-12 – Projected Maximum Annual Volume of Timber Harvested by Decade in MMCF (Million Cubic Feet) and MMBF (Million Board Feet)

Decade	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
First	108 MMCF 646 MMBF	105 MMCF 632 MMBF	105 MMCF 629 MMBF	83 MMCF 498 MMBF	133 MMCF 800 MMBF
Fifth	108 MMCF 646 MMBF	105 MMCF 632 MMBF	105 MMCF 629 MMBF	83 MMCF 498 MMBF	100 MMCF 601 MMBF
Tenth	108 MMCF 646 MMBF	105 MMCF 632 MMBF	105 MMCF 629 MMBF	83 MMCF 498 MMBF	113 MMCF 679 MMBF

Alternative 1 – Alternative 1 could produce a maximum estimated volume of 107,700 MCF, or 65 MMBF, in decades 1-10. A 6,000-acre per year treatment cap was imposed during modeling to address a Biological Opinion requirement for the T&E Species Amendment to the 1986 Forest Plan, along with a constraint that ensured a non-declining even flow of timber production.

Alternative 2 - Alternative 2 could produce a maximum estimated volume of 105,400 MCF, or 63 MMBF, in decades 1-10, which is only 3 percent less than Alternative 1. Alternative 2 also has slightly less suitable acres than Alternative 1. A 6,000-acre per year treatment cap was imposed during modeling, along with a constraint that ensured a non-declining even flow of timber production.

Alternative 2 Modified - Alternative 2M could produce a maximum estimated volume of 104,800 MCF, or 63 MMBF, in decades 1-10, which is only 3 percent less than Alternative 1. Alternative 2 also has slightly less suitable acres than Alternatives 1 and 2. A 6,000-acre per year treatment cap was imposed during modeling, along with a constraint that ensured a non-declining even flow of timber production.

Alternative 3 - Alternative 3 could produce a maximum estimated volume of 83,000 MCF, or 50 MMBF, in decades 1-10, which is about 23 percent less than Alternative 1. This difference reflects a 24 percent reduction in suitable acres between the two alternatives. A 6,000-acre per year treatment cap was imposed during modeling, along with a constraint that ensured a non-declining even flow of timber production.

Alternative 4 - Alternative 4 could produce a maximum estimated volume of 133,300 MCF, or 80 MMBF, in decade 1, which is about 24 percent more than Alternative 1. However, by decade 5 the volume decreases to 100,100 MCF, which is 7 percent less than Alternative 1. By decade 10 the volume increases to 113,200 MCF, or 5 percent more than Alternative 1. The main reason the volume fluctuates so much in Alternative 4 is that the non-declining even flow constraint was removed during modeling to allow this alternative to achieve age class desired conditions in a more effective manner. This departure was used because it was "…reasonable to expect that overall multiple use objectives would otherwise be better attained" [36 CFR 219.16 (a)(3)(iv)]. However, an overall decadal volume cap was imposed to ensure that the acres treated did not exceed the long-term sustained yield capacity (see below). No cap for acres treated was imposed on this alternative.

Long-term Sustained Yield Capacity (LTSYC)

The LTSYC represents the highest uniform yield of wood that may be sustained under a specified management emphasis. The LTSYC also represents the volume of wood that may be produced while meeting all management requirements for protection of other resources. The following table identifies the LTSYC for the Forest, and for each alternative. The amounts shown are decadal volumes.

Table TR-13. Long-term Sustained Yield Capacity by Alternative
(in Millions of Cubic Feet and Millions of Board Feet per Year)

Alternative 1	Alternative 2	Alternative 2M	Alternative 3	Alternative 4
14.8 MMCF/yr 89 MMBF/yr	15.0 MMCF/yr 90 MMBF/yr	14.9 MMCF/yr 90 MMBF/yr	12.8 MMCF/yr 77 MMBF/yr	13.9 MMCF/yr 83 MMBF/yr

Indicator 3 – Acres by Harvest Method by Alternative

The analysis below discusses some of the harvest trends seen through time for each alternative, or between alternatives. The effects that these harvest methods may have on other resources are covered in other resource sections in this chapter, such as Scenic Environment and Vegetation Management. For the purpose of this exercise, uneven-aged harvest methods (individual tree and group selection) are assumed to fall into other harvest method categories for the following reasons:

- Although uneven-aged harvest can be an important silvicultural tool, it is not likely to be used extensively in the near future to achieve the desired conditions of age class and habitat diversity. Individual tree selection, in particular, would not contribute to creating young age classes. Also, natural succession would emulate the effects of individual tree selection over time, and natural succession would dominate vegetation conditions on over 60 percent of the Forest under all alternatives.

- The intensity of tree removal and effects from uneven-aged and intermediate harvests are similar in some ways. In commercial thinning, the objective is to increase the growth and yield of fairly high-value trees for future harvest; whereas individual tree selection may choose to leave trees behind for a variety of reasons, including wildlife habitat, soil stability, or visual concerns. Although the individual tree method would promote uneven-aged stand conditions over time, the effects from harvest in any given decade would be very similar to a commercial thin in terms of volume output, acres treated, and impacts on other resources.

- The intensity and effects of group selections and clearcut regeneration harvests are similar in some ways. Group selections rarely exceed 2 acres, whereas clearcuts with reserve trees typically do not exceed 40 acres. However, both systems remove the vast majority of trees from the site with the objective of regenerating the area to more shade-intolerant species than individual tree selection harvests.

Table TR-14 shows the maximum amount of acres that the Spectrum model predicted would be treated by different harvest method by alternative, over the next decade, the 5th decade, and the 10th decade.

Table TR-14 – Projected Maximum Acreage of Timber Harvest by Harvest Method by Decade

Acres in Decade 1: 2006-2015					
Harvest Method	**Alt. 1**	**Alt. 2**	**Alt. 2M**	**Alt. 3**	**Alt. 4**
Intermediate Harvests	27,411	11,324	11,335	20,382	0
Two-aged Harvests	18,092	16,396	17,239	8,602	23,800
Clearcuts with Reserve Trees	5,860	12,735	11,862	9,435	14,963
Shelterwood Harvests	3,458	4,841	4,902	2,345	12,810
Totals	54,821	45,296	45,338	40,764	51,573
Acres in Decade 5: 2046-2055					
Intermediate Harvests	639	1,032	848	560	2,614
Two-aged Harvests	15,788	16,633	16,663	12,749	15,337
Clearcuts with Reserve Trees	9,416	9,920	9,779	8,893	14,701
Shelterwood Harvests	31,778	24,507	24,232	16,777	10,929
Totals	57,621	52,092	51,522	38,977	43,581
Acres in Decade 10: 2096-2105					
Intermediate Harvests	19,615	9,460	12,480	8,706	8,758
Two-aged Harvests	14,917	16,008	15,640	12,622	18,056
Clearcuts with Reserve Trees	10,592	13,181	12,567	9,626	15,894
Shelterwood Harvests	14,876	13,375	13,348	9,288	9,053
Totals	60,000	52,025	54,035	40,184	51,761

Alternative 1 – In decade 1, intermediate thinning was included as 50 percent of the harvests, based on past harvesting patterns under the 1986 Plan. Two-aged harvests are the bulk of the remaining treatments, with clearcuts only comprising about 10 percent of the harvest. By decade 5, the model is choosing very little intermediate harvest, because most of the stands have reached an age where commercial thinning is no longer appropriate. Shelterwood and two-aged make up most of the harvests, with clearcuts comprising about 16 percent. By decade 10, a large amount of intermediate thinning is needed to improve the growth and yield of maturing trees. The amounts of shelterwood and two-aged harvests are very similar, and both are being used at a rate that is about 7 percent greater than clearcutting with reserve trees.

Alternatives 2 and 2M – In decade 1, intermediate thinning was included as 25 percent of the harvests, based on the assumption that current stands would benefit from this level of treatment over the next 10 years. Harvest levels for these two alternatives are very similar. Two-aged and clearcut harvests are used extensively to regenerate stands and begin the process of increasing age class diversity. Because of less thinning, the overall amount of harvest is somewhat less than in Alternative 1, although the volume outputs are similar. By decade 5 the total harvest acres have increased somewhat, with shelterwoods and two-aged cuts as the dominant harvest methods, and very little thinning due to the fact that most stands are too old or too young to benefit from this treatment. Again, harvest levels are very similar for both alternatives. In decade 10, the overall harvest is similar to decade 5, but there is a relatively even mix of harvest methods being used to maintain desired vegetation conditions. Alternative 2M is treating slightly more acres than Alternative 2, primarily in intermediate harvests.

Alternative 3 - In decade 1, intermediate thinning was included as 50 percent of the harvests, based on past harvesting patterns under the 1986 Forest Plan. Clearcutting would be the next most common method used, followed closely by two-aged harvests. By decade 5, the model is choosing very little intermediate harvest, because most of the stands have reached an age where commercial thinning is no longer appropriate. Shelterwood and two-aged make up most of the harvests, with clearcuts comprising about 23 percent. By decade 10, a larger amount of intermediate thinning is needed to improve the growth and yield of maturing trees. The amounts of shelterwood and clearcut harvests are very similar, and both are being used at a rate that is about 30-35 percent less than two-aged harvests. Overall harvest rates are the lowest of all alternatives for all decades primarily because the suited base is considerably smaller.

Alternative 4 – Alternative 4 was designed to achieve desired vegetation conditions, including restoration, without quite as many management constraints. Therefore, no acre cap or thinning constraint was applied, and the ASQ did not have to meet the non-declining even flow requirement because this alternative better attained the multiple-use objectives and it did not exceed the LTSYC. In the first decade the model avoids thinning in order to more efficiently regenerate stands so that they will contribute to age class diversity in the future. The relatively high amounts of regeneration harvest early on allow the model to thin more trees by decade 5, while not having to harvest as much as Alternatives 1 or 2. In decade 10, the model is still harvesting less than Alternatives 1 or 2, primarily because it is trying to more effectively meet desired age class conditions by retaining more trees in the mid and mid-late successional stages.

Cumulative Effects

Timber Supply

Overall, the range of suitable acres and volume outputs between alternatives is not very large. This is indicative of the relatively similar amounts of suited timberlands between alternatives, and the extensive management constraints that exist to a large degree under all alternatives. These constraints—including listed species habitat, stream channel buffers, backcountry recreation prescriptions, special areas, visually sensitive areas, and tentatively unsuited lands—have the cumulative effect of narrowing: 1) the amount of lands available to actively manage, 2) the expected timber supply off those lands, and 3) the decision space the Responsible Official has in using these indicators as rationale for choosing a preferred management alternative.

As displayed in Table TR-9, approximately 786,800 acres (almost 86 percent of the total Monongahela NFS lands) are tentatively suitable for timber production. Data collected in 1999 and 2000 from the USDA Forest Service Northeastern Research Station Forest Inventory Analysis indicate the MNF is growing, on an average annual basis, 3.6 times more wood than is being harvested. This data includes growth losses due to natural mortality. Table TR-10 displays the acres and categories by alternative of tentatively suitable lands taken out of consideration for timber management. None of the alternatives has more than 40 percent of Monongahela NFS lands available for timber management. It is highly unlikely that any substantial management activities will occur on those lands that are not suitable for timber management. The combination of land not available for timber management, and land that is available but probably will not be managed for timber, means that most of the Forest will not be affected by timber management activities over the next 10 years.

The lack of management over a large portion of the Forest was not as much a concern when the analysis for the 1986 Forest Plan was taking place because at that time the Forest was much younger. Also active timber management had been occurring on a fairly regular basis for over 25 years (see Table TR-15). From 1960 through 1985 (26 years) there were 5 years when the Forest sold less than 15 MMBF of timber products. However, in the 19 years from 1986 through 2004 there were 9 years when the Forest sold less than 15 MMBF. Additionally, because the Forest is now older and still mostly even-aged forest in the older successional stages, it is likely there will be a loss of timber resources on those lands that are considered not suitable for timber management in the next 10 years. These losses will probably still occur somewhat on lands suitable for timber production but at a much slower rate. Some tree species such as scarlet oak and black cherry are reaching or have already attained what is considered to be financial maturity. Other species such as American beech and hemlock are dying from attacks by non-native insects and diseases. As these trees begin to decay or as the live wood deteriorates, their financial value declines. Eventually, as the trees die, they no longer have any financial value although they do provide habitat and food for various species and nutrients for nearby living vegetation.

Table TR-15. Volume of Timber Sold on MNF Land in MMBF, 1960-2004

1960-1969			1970-1979			1980-1989			1990-1999			2000-2004	
Year	Volume Sold		Year	Volume Sold		Year	Volume Sold		Year	Volume Sold		Year	Volume Sold
1960	21.9		1970	36.5		1980	16.8		1990	34.0		2000	3.9
1961	24.9		1971	30.5		1981	38.2		1991	39.0		2001	13.9
1962	35.7		1972	33.9		1982	27		1992	35.4		2002	12.8
1963	35.5		1973	13.2		1983	32.4		1993	30.0		2003	2.1
1964	35.6		1974	0.9		1984	26.7		1994	26.7		2004	2.1
1965	47.4		1975	1.0		1985	31.4		1995	25.6		2005	8.4
1966	45.9		1976	0.0		1986	32.4		1996	12.2			
1967	55.0		1977	10.2		1987	30.0		1997	12.7			
1968	37.0		1978	23.6		1988	36.0		1998	9.9			
1969	56.6		1979	15.5		1989	39.0		1999	9.6			
Decade Total	**395.5**			**165.3**			**309.9**			**235.1**			**43.2**

If the maximum amount of management activity is achieved in all alternatives over the next 10 years, Alternative 3 would have the most amount of timber value and supply lost because it has the most acres in lands that would be considered as not suited for timber management. Conversely, Alternative 4 would have the least amount of timber value lost because it has the most acres available for timber management.

As noted in the *Current Conditions* section, the dramatic decline in timber volume from 1993 on was in part due to Forest reorganizations based on expected budget cuts and changes in management emphasis. The more recent (2003-2004) steep declines in timber volume were due to Amendment #6 to the 1986 Forest Plan that met habitat requirements for T&E species. The projected annual volumes seen in Table TR-12 are well above most of the volume figures in Table TR15, raising the question, how does the Forest expect to achieve such elevated timber targets?

The simple answer to that question is that the volume estimates in Table TR-12 are not targets; they represent modeled outputs of the maximum sustainable timber harvest that could occur for each alternative, given a number of factors, including available and suitable acres to manage, a long list of management constraints, and the relative ability of each alternative to achieve desired vegetation conditions in the 2006 Forest Plan. Given such unknowns as future budget levels, potential appeals and litigation, natural disturbances, and uncalculated constraints, it is difficult to say whether the projected ASQ numbers will ever be reached, but it is assumed that they will not be exceeded.

Cumulative Effects from Counties that Encompass the MNF

Monongahela NFS lands represent 21 percent of the acres of the 10 counties that have land within the proclamation boundary. These acres represent some of the largest blocks of contiguous forested acres within West Virginia.

Land ownership patterns on private lands have been changing since the analysis for the 1986 Forest Plan was completed. The trend over the past 80 years has been for agricultural land to revert to forest, but we are now seeing trends in a different direction. Larger landowners have been dividing and selling their forested properties, resulting in more individual owners with smaller tracts of land. Many of these forested tracts have become residential areas where the landowners are not willing to harvest any trees on their property for commercial forest products. Other tracts are now too small to be economically efficient for timber management. The overall result is a fragmented pattern of ownership, with many small tracts of land converted from previous or potential timber management to various other uses. Management on most private land tends to be unpredictable in the long term, as priorities can change with ownership.

The cumulative effect for NFS lands in counties within the MNF proclamation boundary on timber supply in the reasonably foreseeable future is less land available for timber harvest due to land ownership fragmentation on private land. Also less land may be available for timber harvest on the Forest due to a variety of concerns, from protection of habitat for listed and sensitive species to an increasing desire by some organizations to reduce or eliminate commercial harvesting of trees on all NFS lands. This may lead to increasing pressure on private and industry-owned lands, on fewer forested acres, to supply the increasing demand of wood products. See Table TR-16 for the amount of change in forested acres on private land for the eight largest counties within the Forest proclamation boundary and for West Virginia as a whole.

Table TR-16 – Change in Forested Land from 1989 to 2000

Area	1989 Acres	2000 Acres	Change (Acres)
Grant County	216,594	217,240	+ 646
Greenbrier County	393,383	393,394	+ 11
Nicholas County	318,414	313,955	- 4,459
Pendleton County	222,412	219,855	- 2,557
Pocahontas County	225,578	200,208	- 25,370
Randolph County	381,839	385,047	+ 3,208
Tucker County	137,300	134,748	- 2,552
Webster County	266,956	260,480	- 6,476
Counties in MNF PB	2,162,476	2,124,927	- 37,549
West Virginia	12,114,000	12,006,900	- 107,100

Mineral Resources

INTRODUCTION

Paleozoic sedimentary rocks underlie and outcrop within the Monongahela National Forest (MNF) area. These rocks represent the Ordovician to the Pennsylvanian periods, and have been folded and faulted by mountain building. Younger alluvial deposits (Quaternary age) occur along streams and rivers. This underlying geology provides the setting for the mineral resources present within the Forest. Mineral resources include commercial quantities of coal, natural gas and limestone; and limited amounts of iron, manganese, silica, gravel and stone. The mineral resource with the most production potential during the planning period is natural gas.

The desired condition for mineral management on the MNF is to provide for exploration, development, and production of mineral and energy resources in an environmentally sound manner. Mineral resource management on the Forest involves coordinating National Forest System (NFS) land and resource uses with exploration, development and production of federally owned or privately owned minerals. Federally owned minerals, primarily natural gas, can be leased for development, although not all areas on the Forest are available. Privately owned minerals may be developed anywhere they occur on the Forest, but activities must be consistent with the mineral deed terms and State law. The Forest strives to control effects from both types of mineral development by reviewing operating plans and approving with appropriate mitigation measures when approval authority rests with the Forest Service, or negotiating with private mineral operators for the implementation of mitigating measures. Operations are also bonded by the appropriate entity for the costs of anticipated site reclamation, to ensure that sites are returned to a condition consistent with the management emphasis of the area.

Need For Change

No significant issues directly related to mineral and geology resources were identified during scoping or the Need For Change analysis process. However, there have been changes to mineral conditions and direction, and in national direction and emphasis in forest planning, since the 1986 Forest Plan, and these changes necessitate the update of minerals information in Plan revision. The changes and needed updates include:

- Land Acquisition and Changes in Mineral Rights Ownership - Changes in coal ownership and prospects for coal development on the MNF in the last planning period indicate that allocating land to a Management Prescription (MP) dedicated to mineral development, such as MP 1.1, or identifying areas of economically recoverable bituminous coal and portals through which coal could be mined would be highly speculative and unreliable, thus not meaningful or beneficial to Plan revision. Therefore, the 1.1 MP in the 1986 Forest Plan was not carried forward into the 2006 Plan.

- Monongahela Forest Plan Amendment on Oil and Gas Leasing and Development - The 1992 Forest Plan Amendment #4 identified federally owned oil and gas available for lease, and authorized the Bureau of Land Management (BLM) to lease such areas after the Forest Service identifies the lease notifications and stipulations that BLM must attach to the lease. In addition to direction on lease conditions, Amendment #4 provided direction on development of federally owned natural gas. This direction was reviewed and incorporated, as appropriate, into the Forest-wide and/or MP sections of the 2006 Plan.

- Forest Planning national direction and emphasis - As was the case for all management direction in the 1986 Forest Plan, there was a need to review, revise and update mineral resource management direction, and incorporate into the revised Plan. This has been done.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect mineral resources available for exploration and development.

Background

Forest Plan direction for the management of mineral resources has been revised during the revision process. Forest-wide desired conditions and goals were added, and a number of the standards and guidelines that were in the 1986 Forest Plan, as amended, were rewritten for clarity and integrated with other Plan resource direction. Some standards and guidelines were eliminated because they were repetitive, or they were better suited to an implementation guide, or they were already covered by law, regulation, or policy. Management Prescription direction was reviewed and updated in a similar manner. The overall result of these direction changes is that revised protection for and from mineral resource activities is much the same as in the 1986 Forest Plan, and desired conditions and goals for mineral management have improved.

The major effects to mineral management that this analysis will assess are related to Forest Plan MPs. The MPs contain management direction for mineral management that could potentially affect mineral exploration and development. In particular, there is a standard that prohibits surface occupancy on federal gas and oil leases in several MPs that would restrict lease operators from exploring and developing gas reserves in all but the outer portions of the prescription unit areas. Because the MP allocation changes by alternative, the potential effects from the MP prohibition of surface occupancy would change as well. This analysis will identify how much gas production may be affected by alternative due to these changes.

Indicators

The following indicators reflect the potential relative change by alternative based on management direction that could have substantial effects on the availability of mineral resources.
- Percent of federally owned natural gas acres available for exploration and development
- Billions of cubic feet of potential natural gas resources available for production from the MNF

Scope of the Analysis

The affected area for direct, indirect and cumulative effects to mineral resources includes the lands administered by the Forest, and lands of other ownership both within and adjacent to the Forest proclamation boundary. This represents the area in which the mineral resources could exist and the lands where mineral resources could be impacted by Forest Plan management strategies, particularly land allocation or standards for management or protection of various Forest resources. Although direct effects are focused on federally owned minerals, indirect and cumulative effects to mineral resources on land ownerships within and adjacent to the Forest proclamation boundary are addressed to lend a broader perspective to the importance of mineral resources within the Forest and to recognize the inter-relationships with those lands.

CURRENT CONDITIONS

Beneath some NFS land the mineral resources are owned by private entities. The amount of private mineral ownership beneath NFS land varies by mineral resource. For example, an estimated 38 percent of NFS land has privately owned oil and gas rights, while 27 percent of NFS land has privately owned coal.

Mineral resources such as iron and manganese, silica, high-calcium limestone, and limestone are either not known to occur in commercial quantities on the NFS land, or demand for them appears to be being met by sources off of NFS land.

Most of the demand for mineral materials—including gravel and stone used for construction, fills, landscaping or building stone—is apparently being met by commercial quarries or sources on private land. Small-scale removal of mineral materials is occurring on the MNF through issuance of personal use permits for less than 20 tons of mineral material.

Coal

Active coal mining on the MNF ceased in the early 1990s. In fact, the private coal estates that were being mined during the past 15 years are now federally owned. No coal mine permit applications on NFS land are pending or known to exist.

Although low in sulfur and high in British Thermal Unit (BTU) value, making them desirable for energy production and as metallurgical grade coals, the coal resources underlying NFS land are scattered and would be costly to develop due to the geologies involved. For the most part, demand for coal is being met from sources in other parts of the United States or world that have lower production costs. At current and foreseeable coal prices, the MNF does not expect to see major or extensive coal mine development and very probably no leasing and development of federally owned coal over the next 10-15 years. However, some underground coal mine development is possible. This development would be associated with the exercise of privately owned coal rights.

Natural Gas Storage

A 50,000-acre natural gas storage field exists beneath the MNF in the Middle Mountain-Glady area. This storage field is authorized by the "Glady Gas Storage Agreement", effective from 1963 until 2013, with likelihood for re-issuance. The Agreement grants the gas storage operator the rights to use and occupy NFS land within the bounds of the storage field to construct, operate, maintain, replace, abandon and remove wells, pipelines and roads for the purposes of gas storage. These activities are expected to continue. Future expansion and clearing within the Glady Gas Storage Field is not foreseen at this time.

Although no proposals are known at this time, it is possible that the Forest could see a proposal to use larger depleted gas reservoirs for gas storage facilities during the 10-15 year planning period. Such proposals could be of particular interest in this region due to its proximity to large population centers, such as Washington, D.C. and Baltimore.

Oil and Natural Gas

Oil has never been found in commercial quantities on the MNF, and there is only a low probability for its occurrence. The natural gas that is produced from the Forest is generally pure methane, containing little water and no known production of hydrogen sulfide (sour) gas.

Natural gas exploration and development on the MNF began in earnest in the 1950s. Within the Forest proclamation boundary and purchase units, between 40 and 50 producing or capable-of-producing gas wells exist. Each gas well site has been between one and four acres of land that have been cleared of trees and maintained as herbaceous vegetation. Additionally, there are just over 100 miles of natural gas pipeline to transport gas produced from these wells, and about 12 miles of single purpose access roads used for well and pipeline maintenance. Total clearing for these facilities is about 620 acres (USDA Forest Service 1991 [EA Appendix C]; USDA Forest Service 1995). Twenty-five of these wells and their associated facilities are on NFS land.

The MNF may contain substantial quantities of natural gas. However, natural gas is not present everywhere underlying the Forest, but occurs associated with certain strata in locations where complex folding and faulting has resulted in a favorable setting for trapping natural gas. Gas exploration and development history demonstrates natural gas occurrence within the Forest. The Oriskany and associated geologic strata have the most likely potential to contain commercial quantities of natural gas. This strata, and in some cases the deeper Tuscarora Formation, are predicted to be the target of gas industry exploration and development within the Forest in the foreseeable future. When the natural gas resource potential based on the reasonably foreseeable gas development scenario is extrapolated, there is about a 19 percent chance of more than 860 billion cubic feet (Bcf) of natural gas underlying the area contained within the Forest proclamation boundary and purchase units. Considering the federally owned gas resource only, there is a similar chance for more than 280 Bcf of natural gas (USDI, Bureau of Land Management 1989; USDI, Bureau of Land Management May 1990; USDA Forest Service 1991 [EA, pages 3-48, 3-49]).

An estimated 24 percent of federally owned oil and gas are currently leased. When someone wants to obtain a federal oil and gas lease, they nominate the area they are interested in leasing to the Department of Interior, BLM. The BLM is responsible for issuing and administering oil and gas leases after the Forest Service consents to the lease issuance on NFS land on the MNF. Consent involves the Forest Service stipulating limits or conditions on the lease necessary for protection of national forest land and resources. Upon receipt of consent from the Forest Service, the BLM sells these leases to the highest bidder at an auction. Oil and gas leases typically terminate in 10 years, but may continue to be in effect as long as the lease is producing gas. An estimated 14 percent of the unleased federally owned oil and gas has been nominated for oil and gas leasing. The Forest continues to process the nominations by identifying applicable lease conditions according to the 1986 Forest Plan Amendment #4, and forwarding those conditions to the BLM for attaching to awarded leases.

Reasonably foreseeable gas development (RFD) has been projected and described for the Forest. The RFD is a projection of the likelihood of gas exploration, development, production and related activities within the MNF proclamation boundary and purchase units. The projections are speculative, but are based on credible geologic and mineral production information. The RFD included an analysis of gas resource potential, and factored in existing limits on gas exploration and development (such as existing Wilderness). The RFD's focus is on gas development potential in the MNF proclamation boundary and purchase units over the life of the Forest Plan. The Forest's RFD was prepared in May 1990 and updated and validated in Forest Plan revision.

The RFD describes typical operator activities associated with natural gas exploration and developments that are expected to continue over the planning period. These activities include:

- Obtaining an oil and gas lease,
- Conducting preliminary investigations, most commonly by geophysical exploration using seismic shot hole or vibroseis methods,
- Exploratory drilling,
- Development and production, and
- Plugging wells and decommissioning facilities that are not part of economical production

(USDA Forest Service 1991 [EA], Appendix C: USDI, Bureau of Land Management May 1990, pp C-4 through C-11; Nolder Memo July 2003).

In the RFD Scenario, planned and potential gas developments were projected to involve the following per decade:

- Clearing about 130 acres for 66 gas well sites; each site about 2 acres,
- Clearing about 138 acres for an estimated 19 miles of new road to access projected well drilling, and
- Clearing about 473 acres for 78 miles of gas pipeline from an estimated 41 producing wells (out of the 66 drilled wells); rights-of-way may be up to 50 feet wide.

It is likely that some of the 66 wells will not yield gas. Consequently, an estimated 50 acres may begin reverting back to forested land shortly after drilling. Cleared areas from producing wells will remain open, supporting herbaceous vegetation, throughout gas production of probably up to

30 years. Due to the intermingled private and federal land and mineral ownership, one half to two thirds of this predicted surface disturbance could be a result of developing privately owned gas (USDA Forest Service 1991 [EA]).

Over the decade that the Forest has been implementing Forest Plan Amendment #4 for natural gas leasing and development, the amount of surface disturbance associated with developments has been substantially below predicted levels as shown in Table MI-1. The gas developments in the right-hand column represent those that have been approved in decisions. Only a portion have actually been implemented.

Table MI-1. Predicted and Actual Natural Gas Development on the MNF

Gas Developments on NFS Land	1990 MNF Oil and Gas Projections for 1991-2009 (new developments)	Amount of New Gas Developments 1991- June 2006
Number of wells drilled	136	27
Total acres of surface disturbance	1536	81
Miles of road	38	3
Miles of pipeline	164	48

The main reasons for these discrepancies are that: 1) the rate of natural gas exploration and development has been less than predicted, and 2) operators have chosen options for development that reduce the total amount of surface disturbance dedicated to gas wells and associated roads and pipelines. For example, operators have reduced surface disturbance by directionally drilling more than one gas well from one well site, which in turn reduces the amount of road and pipeline needed to support the gas wells. They have also co-located pipelines with roads to reduce the amount of new clearing and surface disturbance needed to support gas development. As long as such practices remain economically feasible, it is expected that these practices would continue where allowed.

Gas drilling to find new gas fields will likely continue. Areas containing gas discoveries will continue to be developed until the full field is delineated and producing. The gas exploration and development is expected to be within predicted amounts over the next 15 years, even with recent increased interests in MNF natural gas deposits as drilling for small gas pockets has become more economical (Nolder Memo 2003).

Current Area Available for Natural Gas Development

The Forest Plan was amended in 1992 to address where and subject to what standards federally owned oil and gas would be leased. The standards and guidelines identified in Forest Plan Amendment #4 were the basis for determining whether federally owned natural gas resource was available for exploration and development. The decision supporting Forest Plan Amendment #4 was that 388,000 acres out of 461,000 acres or 84 percent of federally owned oil and gas on the MNF are available for natural gas exploration and development (USDA Forest Service 1991 [DN/FONSI, p. 10-11]). The decision supporting Forest Plan Amendment #4 recognized that some standards and guidelines to protect forest resources made small areas unavailable for surface occupancy by gas operations (roads, well sites and pipelines) (USDA Forest Service 1991 [EA pp. 2-27, 2-28]). It also recognized that avoiding small areas and directionally drilling for gas (drilling at an angle from the surface to a target rock unit that is not directly below the well surface location) may cost gas operators more, but as long as the areas in which surface occupancy was prohibited were no larger than about 640 acres (1 square mile), the natural gas could still be discovered and produced, and thus it would be available (USDA Forest Service 1991. [EA p. 3-50]).

The 1986 Forest Plan and wilderness designation had removed 99,000 acres of federally owned oil and gas acres from consideration for oil and gas leasing or surface occupancy (USDA Forest Service 1991 [DN/FONSI, p. 10-11]). In actuality, about 77,000 acres (76,000 acres in Wilderness and 1000 acres outside of wilderness) of the 99,000 acres are unavailable for gas exploration and development because the natural gas within 20,000 acres could be explored and extracted from adjacent areas. Therefore, out of 560,000 acres of federally owned oil and gas, 148,000 acres or 26 percent--including acres removed by Wilderness designation or made unavailable by Forest Plan standards that disallow surface occupancy in MP 6.2, large MP 8.0 areas, and within municipal watersheds--are unavailable; leaving 412,000 acres or roughly 74 percent of the federally owned gas available for exploration and development. The estimate of acres available and unavailable take into account that some federal gas within areas where surface occupancy is prohibited may be reached from adjacent areas by directional drilling.

Natural Gas Production Potential

A report prepared by the BLM notes that the MNF may contain significant quantities of natural gas. The report classified areas within the MNF on the basis of the natural gas potential from the Oriskany and associated formations. Areas classified as having inferred or hypothetical Oriskany gas resources were used to calculate reserve estimates because these areas are either within geologic blocks that are currently producing natural gas or contain similar geologic structures to those producing gas with a reasonable expectation for gas production. About 1,317,000 acres or 75 percent of the area within the Forest Proclamation boundary and purchase units are classified as having inferred or hypothetical Oriskany natural gas resources. Potential natural gas production from the Oriskany and associated formations was estimated for the MNF based on 1 Bcf per well ultimate recovery, or 1.56 million cubic feet (Mcf) (0.00156 Bcf) per acre on 25 to 50 percent of the acres within any individual geologic block in which gas is discovered. There is additional potential for gas from other formations, but reserve estimates have not been made due to insufficient data. Thus, reserve estimates contained herein represent only those from the Oriskany and associated formations, and not, for example, the Tuscarora Formation, which is currently being drilled and tested on the northern portion of the Forest (USDI Bureau of Land Management 1989, USDI Bureau of Land Management May 1990).

Areas classified as having inferred or hypothetical Oriskany natural gas resources have about a 19 percent chance for recovery of 1.56 Mcf of natural gas per acre on 25 to 50 percent of the acres (USDI, Bureau of Land Management 1989 and USDI, Bureau of Land Management May 1990). In 1991, the area within the MNF proclamation boundary and purchase units was estimated to contain proven gas reserves of 39 Bcf, with a 19 percent chance for an additional

867 Bcf of natural gas. Considering the federal gas resource only, there is a similar chance for the existence of an estimated 284 Bcf of natural gas (USDA Forest Service 1991 [EA]). After applying the existing Forest Plan standards, federally owned gas available for exploration and development could produce an estimated 232 Bcf of Oriskany gas (USDA Forest Service 1991 [DN/FONSI, p. 15]). The estimates represent the potential Oriskany gas production if 37.5 percent or the average of 25 to 50 percent, of the acres available for gas development produced natural gas.

Table MI-2 summarizes the estimates of Oriskany and associated strata natural gas production potential from the Forest, given the gas acres that are available for exploration, development, and production under the 1986 Forest Plan.

Table MI-2. Potential Oriskany and Associated Strata Natural Gas Production

Gas Production Potential	Forest Plan Amendment #4 with 37.5 percent of lands productive	Forest Plan Amendment # 4 with 25 to 50 percent of lands productive (as a range)
Potential (19 percent chance) for production from within the MNF proclamation boundary	867	474-948
Potential (19 percent chance) for Production from federally owned oil and gas within the MNF	232	131-261

ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Laws, Regulations, and Policies

Federal laws and regulations guide the management of mineral resources on NFS lands. Mineral resources on the MNF are separated into three categories, whose exploration and development is guided by different statutes.

1) Privately owned minerals are subject to the terms of the mineral severance deed, state law, and various federal laws, most of which are not within Forest Service authority to administer or enforce. Some examples include:
    - Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201-1328) applies to all surface coal mining operations. It is administered and enforced by the USDI, Office of Surface Mining.
    - West Virginia Oil and Gas Laws and Administrative Regulations apply to gas development. The WV Division of Environmental Protection, Office of Oil and Gas administers and enforces these rules.

2) Leasable minerals include federally owned deposits of coal, gas, oil, oil shale, phosphate, sodium, potassium, and geothermal resources. The Mineral Leasing Act of 1920 and its amendments authorize the Secretary of the Interior to lease land for development of these minerals. The Mineral Leasing Act for Acquired Lands of August 7, 1947 extended provisions of the Mineral Leasing Act of 1920 to acquired lands which are present on the MNF. The Federal Onshore Oil and Gas Leasing Reform Act of December 22, 1987, which amended the Mineral Leasing Acts, specifies the Forest Service role in leasing, and analyzing and approving surface-disturbing activities with respect to oil and gas leases. The Forest Service reviews, approves, and administers the surface activities on the Forest, and the BLM manages the exploration and development program.

3) Mineral Materials, also called salable or common variety materials, are generally deposits of sand, gravel, or stone that are used for road surfacing or building materials. The Minerals Materials Act of 1947 states that these minerals on NFS lands are subject to disposal by the Secretary of Agriculture, and are not subject to mining and leasing laws.

National laws and regulations have also been interpreted for implementation in Forest Service Manuals, Handbooks, and Regional Guides. All management activities and facilities must comply with these laws, regulations, and policies, which are not only intended to provide general guidance for implementation, but also protection of resources.

Forest Plan Direction

Desired conditions, goals, objectives, standards, and guidelines provide guidance for mineral resources at both the Forest-wide and MP levels. Much of the mineral-related direction can be found in the Mineral Resources section of the Forest-wide Direction in Chapter II of the 2006 Forest Plan. However, additional mineral-related direction has been integrated and linked to and from other resource sections.

Effects on mineral management within the Forest, and natural gas development in particular, are primarily caused by the standards that restrict how, when, and where mineral development may occur in order to mitigate effects on the land and its resources, or by standards that control activities that may occur within MPs. These effects are described in the General Effects section below.

Forest Plan Implementation

There are several opportunities to mitigate effects of federal gas leasing and development on NFS land. The first occurs as part of the Forest Service consent to lease federally owned oil and gas. Forest Plan standards that have a substantial bearing on the ability or cost to develop the gas within a lease are forwarded to the BLM for incorporating into the lease. Examples include:

- Prohibitions on surface occupancy that apply to areas 640 acres or larger because this standard determines the parts of the lease area in which gas could not be extracted;
- Prohibitions on surface occupancy that affect areas between 20 and 640 acres in size because this standard would require directional drilling, which is more costly;

- Timing restrictions that result in delays of more than 60 days in order to operate on the lease, like seasonal restrictions on drilling or construction activities near developed recreation areas.

In addition, oil and gas leases issued since 1992 contain notification to the lessee that operations under the lease will be consistent with standards and guidelines in the MNF Forest Plan.

Another opportunity to mitigate the effects of federal gas development occurs during project-level National Environmental Policy Act (NEPA) analysis. Surface use plans or operating plans for proposed activities within the lease must be reviewed and approved by the Forest Service before the proposed use of NFS land is authorized. NEPA compliance is part of the approval process. Through NEPA analysis and decision-making; site-specific mitigation measures, monitoring needs, or bonding requirements are identified and may be applied to the proposed surface use as appropriate. Operations are inspected for compliance with approved operating plans, which provides another opportunity to ensure effects are mitigated.

Effects Common to All Alternatives

Forest Plan direction does not preclude or interfere with a private mineral owners' rights to explore for and develop privately owned minerals. The exercise of these mineral rights is controlled by deed and State law. As such, direct effects on private mineral rights as a result of implementing the Forest Plan are not expected.

Effects on federally owned natural gas are caused by standards or guidelines that restrict gas leasing and development. Forest–wide standards mitigate effects of gas development on the land and its resources (See Management Direction for Mineral and Geology Resources) and can result in prohibitions on use of the land surface for gas exploration and development. This may make certain areas of federally owned gas unavailable for exploration and development.

Federally owned minerals, natural gas included, within congressionally designated wildernesses are withdrawn from leasing. Therefore, federally owned natural gas is unavailable for development on 76,000 acres of existing congressionally designated wildernesses under all alternatives.

Most Forest-wide standards, including ones that control timing of gas operations or mitigate potential effects to Forest resources, may increase federal gas exploration and development costs somewhat, but would not be sufficiently higher in cost such that industry would avoid leasing or developing federally owned gas. This is because most of these standards apply to small areas that can be avoided by gas developments without substantially compromising the ability to find and extract gas, or gas exploration and development can be scheduled to avoid the restricted season. A few examples of standards that have these effects include those pertaining to soil and water, developed recreation, and administrative sites.

Standards to protect soil and water require gas well sites to be located outside of 100-foot wide buffers of perennial channels and gas well drilling pits to be located outside of channel (stream) buffers (25 feet wide up to the riparian area width). Gas pipelines and access roads may cross channels as close to right angles as possible to minimize the disturbance to riparian habitat and the potential to degrade water quality. These standards notwithstanding, sufficient area and locations would still exist to explore for or extract gas.

Similarly, standards that require gas operations to avoid developed recreation sites, and to avoid drilling and construction in support of gas development within 500 feet of the recreation site during the recreation use season would still allow gas development to occur, albeit with extra cost or perhaps extra planning on the lessee's part. Standards that prohibit use of small areas of NFS land, such as administrative sites, for federal gas development, would still allow discovering and extracting gas by drilling from outside the protected area at an angle (directional drilling) into the gas-bearing strata below the protected area.

Forest-wide standards that prohibit surface occupancy of areas that are larger than 640 contiguous acres could result in gas unavailable for development. These areas include certain MPs (such as 5.1, 6.2, and some 8.0) and could also include specific resource-related areas. For example, surface occupancy is prohibited where certain threatened, endangered, and proposed (TEP) populations exist (Virginia big-eared bat, Indiana bat hibernacula and key areas, Cheat Mountain salamander, bald eagle nests, shale barren rock cress) or in municipal watersheds, but only where these areas attain a size of 640 or more contiguous federally owned gas acres do they become unavailable. Effects from these prohibitions are displayed and discussed in the Direct and Indirect Effects section below.

Direct and Indirect Effects by Alternative

<u>Percent of Federally Owned Gas Acres Available For Exploration And Development</u>

Forest Plan management strategies may affect mineral resources available for exploration and development. In particular, federally owned natural gas becomes unavailable for exploration and development when surface disturbance or surface occupancy required to drill for and extract gas is not allowed within areas that are larger than 640 contiguous acres. These areas are displayed in Table MI-3. Federally owned natural gas is present within 573,000 acres of MNF NFS land.

Alternative 1 - Table MI-3 shows that Forest Plan standards that prohibit surface occupancy within federal oil and gas leases result in 146,000 acres out of 573,000 acres, or 25 percent, of federally owned natural gas unavailable for exploration, development or production. The area unavailable includes MP 5.0, MP 6.2, some large MP 8.0 areas such as the Dolly Sods Scenic Area, and municipal watersheds. Portions of the periphery of these areas, except for Wilderness, were considered available when adjacent federal gas was available for leasing with surface occupancy. The acreages in Table MI-3 reflect the acres that are unavailable because they could not be reached by directionally drilling from federally owned gas outside of the boundary of the area in which surface occupancy is prohibited.

Table MI-3. Acres and Percent of Federally Owned Gas within MNF Unavailable for Gas Leasing and Development by Alternative

Affected Area	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
	Acres	Acres	Acres	Acres	Acres
MP 5.0	76,000	76,000	76,000	76,000	76,000
MP 5.1, 6.2, or SPNM portions of 8.1	66,000	57,000	71,000	127,000	38,000
MP 8 (excluding MP 8.1)	1,000	1,000	1,000	1,000	1,000
Municipal watersheds	3,000	0	0	0	0
Total acres affected	**146,000**	**134,000**	**148,000**	**204,000**	**115,000**
Percent of federally owned gas affected	**25%**	**23%**	**26%**	**36%**	**20%**

The rest of the federally owned natural gas, 427,000 acres or 75 percent, is considered available for exploration, development and production. Gas operations may be prohibited within small areas, and timing restrictions may dictate when certain operations may occur, all of which may increase the development costs. However, increases in the costs of operations are not expected to be sufficiently high to preclude exploration and development within these 427,000 acres.

Alternative 1 meets the 2006 Forest Plan management direction objective for mineral and geology resources (MG06) of keeping 70 to 80 percent of federally owned oil and gas available for exploration, development, and production.

Indirect effects on adjacent landowners, owners of oil and gas beneath NFS land, and existing oil and gas lessees could occur depending on the availability of federal gas for exploration or development. Privately owned gas or gas adjacent to federally owned gas may remain undeveloped if the federal gas needed to make an operation economically feasible is unavailable for development. There have been no indications that substantial indirect effects, either adverse or beneficial, have occurred to adjacent landowners, oil and gas owners, or current oil and gas lessees since implementation of Forest Plan Amendment #4, and there is no expectation that these indirect effects will change substantially in the future.

It is noted that 2,000 fewer acres show as unavailable in this alternative compared to what is shown in the *Current Area Available for Natural Gas Development* discussion. This is due to differences in how the acreages were tallied in 1991 (manually using a dot grid) compared to today (electronically using geographic information system). There has been no change to the federally owned gas available as a result of Amendments 1, 2, 3, 5 or 6 to the Forest Plan.

Alternative 2 - Table MI-3 shows that Forest Plan standards that prohibit surface occupancy within federal oil and gas leases result in 134,000 acres out of 573,000 acres, or 23 percent, of federally owned natural gas unavailable for exploration, development or production. The area unavailable includes MP 5.0, MP 5.1, MP 6.2, semi-primitive non-motorized (SPNM) portions of MP 8.1 (National Recreation Area) and some large MP 8.0 areas such as the Dolly Sods Scenic Area. Portions of the periphery of these areas, except for Wilderness, were considered available when adjacent federal gas was available for leasing with surface occupancy. The acreages in Table MI-3 reflect the acres that are unavailable after subtracting acres that could be reached by directionally drilling from federally owned gas outside of the boundary of the area in which surface occupancy is prohibited.

The balance of the federally owned natural gas, 439,000 acres or 77 percent, is considered available for exploration, development and production. Gas operations may be prohibited within small areas, and timing restrictions may dictate when certain operations may occur, all of which may increase the development costs. However, increases in operation costs are not expected to be sufficiently high to preclude exploration and development within the 439,000 acres.

Alternative 2 meets the 2006 Forest Plan management direction objective for mineral and geology resources (MG06) of keeping 70 to 80 percent of federally owned oil and gas available for exploration, development, and production.

Under Alternatives 2, 2M, 3, and 4, there is no standard that prohibits surface occupancy within municipal watersheds; instead, impacts to municipal watersheds would be evaluated during site-specific analysis of proposed gas development, and addressed through mitigation measures.

Alternative 2 includes about 4,400 fewer acres of NFS with MPs in which surface occupancy is prohibited than Alternative 1; 127,900 NFS in MP 6.2 versus 123,500 in MPs 5.1 and 6.2, respectively, yet 12,000 fewer acres of federally owned natural gas are unavailable in Alternative 2. This is because there are fewer acres of federally owned oil and gas in the MP 5.1, MP 6.2, and SPNM portions of MP 8.1 in Alternative 2 that are affected by the prohibition on surface occupancy than within the MP 6.2 areas in Alternative 1.

Indirect effects on adjacent landowners, owners of gas and oil beneath NFS land, and existing oil and gas lessees would be the same as those stated for Alternative 1, above.

Alternative 2M - Table MI-3 shows that Forest Plan standards that prohibit surface occupancy within federal oil and gas leases result in 148,000 acres out of 573,000 acres, or 26 percent, of federally owned natural gas unavailable for exploration, development or production. The area unavailable includes MP 5.0, MP 5.1, MP 6.2, semi-primitive non-motorized (SPNM) portions of MP 8.1 (National Recreation Area) and some large MP 8.0 areas such as the Dolly Sods Scenic Area. Portions of the periphery of these areas, except for Wilderness, were considered available when adjacent federal gas was available for leasing with surface occupancy. The acreages in Table MI-3 reflect the acres that are unavailable after subtracting acres that could be reached by directionally drilling from federally owned gas outside of the boundary of the area in which surface occupancy is prohibited.

The balance of the federally owned natural gas, 425,000 acres or 74 percent, is considered available for exploration, development and production. Gas operations may be prohibited within small areas, and timing restrictions may dictate when certain operations may occur, all of which may increase the development costs. However, increases in operation costs are not expected to be sufficiently high to preclude exploration and development within the 425,000 acres.

Alternative 2M meets the 2006 Forest Plan management direction objective for mineral and geology resources (MG06) of keeping 70 to 80 percent of federally owned oil and gas available for exploration, development, and production.

Alternative 2M includes about 2,000 more acres of NFS with MPs in which surface occupancy is prohibited than Alternative 1, which represents the current condition.

Indirect effects on adjacent landowners, owners of gas and oil beneath NFS land, and existing oil and gas lessees would be the same as those stated for Alternative 1, above.

Alternative 3 - Table MI-3 shows that Forest Plan standards that prohibit surface occupancy within federal oil and gas leases result in 204,000 acres out of 573,000 acres, or 36 percent, of federally owned natural gas unavailable for exploration, development or production. The area unavailable includes MP 5.0, MP 5.1, MP 6.2, SPNM portions of MP 8.1 (the NRA) and some large MP 8.0 areas such as the Dolly Sods Scenic Area. Portions of the periphery of these areas, except for Wilderness, were considered available when adjacent federal gas was available for leasing with surface occupancy. The acreages in Table MI-3 reflect the acres that are unavailable after subtracting acres that could be reached by directionally drilling from federally owned gas outside of the boundary of the area in which surface occupancy is prohibited.

The balance of the federally owned natural gas, 369,000 acres or 64 percent, is considered available for exploration, development and production. Gas operations may be prohibited within small areas and timing restrictions my dictate when certain operations may occur, all of which may increase the development costs. However, increases in the operation costs are not expected to be sufficiently high to preclude exploration and development within these 369,000 acres.

Alternative 3 does not meet the 2006 Forest Plan management direction objective for mineral and geology resources (MG06) of keeping 70 to 80 percent of federally owned oil and gas available for exploration, development, and production.

Alternative 3 includes about 195,250 more acres of NFS land with MPs in which surface occupancy is prohibited than Alternative 1; 127,900 NFS in MP 6.2 verses 323,150 in MP 5.1 and 6.2, respectively, yet only 58,000 more acres of federally owned natural gas are unavailable in Alternative 3. This is because not all of the acreage allocated to MP 5.1, MP 6.2 and SPNM portions of MP 8.1 in Alternative 3 contain federally owned oil and gas that are affected by the prohibition on surface occupancy.

Indirect effects on adjacent landowners, owners of oil and gas beneath NFS land, and existing oil and gas lessees could occur depending on the availability of federal gas for exploration or development. Privately owned gas or gas adjacent to federally owned gas may remain undeveloped if the federal gas needed to make an operation economically feasible is unavailable for development. Although, there have been no indications that substantial indirect effects, either adverse or beneficial, have occurred to adjacent landowners, oil and gas owners, or current oil and gas lessees since implementation of Forest Plan Amendment #4, this alternative makes substantially more acres of federally owned gas unavailable. With substantially fewer acres of federally owned gas available, there is increased risk compared to the other alternatives that privately owned gas reserves within or adjacent to NFS land may remain undeveloped due to economics. For example, gas produced from private oil and gas estates alone may not contain the volume of gas needed to make the gas pipeline needed to transport the gas to market economically feasible.

Alternative 4 - Table MI-3 shows that Forest Plan standards that prohibit surface occupancy within federal oil and gas leases result in 115,000 acres out of 573,000 acres, or 20 percent, of federally owned natural gas unavailable for exploration, development or production. The area unavailable includes MP 5.0, MP 6.2, SPNM portions of MP 8.1 (the NRA) and some large MP 8.0 areas such as the Dolly Sods Scenic Area. Portions of the periphery of these areas, except for Wilderness, were considered available when adjacent federal gas was available for leasing with surface occupancy. The acreages in Table MI-3 reflect the acres that are unavailable after subtracting acres that could be reached by directionally drilling from federally owned gas outside of the boundary of the area in which surface occupancy is prohibited.

The balance of the federally owned natural gas, 458,000 acres or 80 percent, is considered available for exploration, development and production. Gas operations may be prohibited within small areas and timing restrictions may dictate when certain operations may occur, all of which may increase development costs. However, increases in the costs of operations are not expected to be sufficiently high to preclude exploration and development within these 458,000 acres.

Alternative 4 meets the 2006 Forest Plan management direction objective for mineral and geology resources (MG06) of keeping 70 to 80 percent of federally owned oil and gas available for exploration, development, and production.

Alternative 4 includes about 78,300 less acres of NFS land with MPs in which surface occupancy is prohibited than Alternative 1; 127,900 NFS in MP 6.2 verses 49,600 in MP 6.2, respectively, yet 31,000 less acres of federally owned natural gas are unavailable in Alternative 4. This is because the acres allocated to MP 6.2 under Alternative 4 are different than those allocated to MP 6.2 under Alternative 1, and the acres allocated to MP 6.2 and the SPNM portions of MP 8.1 in Alternative 4 contain proportionately fewer acres of federally owned oil and gas that are affected by the prohibition on surface occupancy.

Indirect effects on adjacent landowners, owners of oil and gas beneath NFS land, and existing oil and gas lessees would be the same as those stated for Alternative 1, above.

<u>Potential Federally Owned Natural Gas Production from the MNF by Alternative</u>

An indicator of the effect that Forest Plan management would have on potential gas production would be the amount of potential Oriskany natural gas available for production from federally owned oil and gas within the MNF. If the federally owned oil and gas were available everywhere except in congressionally designated wildernesses, estimated gas production potential is 151-303 Bcf. Using the same method as was used to generate the estimates shown in Table MI-4, Oriskany gas production potential would be 227 Bcf if federally owned gas was available everywhere except in Congressional designated wilderness.

Table MI-4. Potential Natural Gas Production from the MNF by Alternative in Bcf

Gas Production Potential	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Potential (19 percent chance) for Production from federally owned oil and gas within the MNF (in billion cubic feet)	195	199	195	165	209
Percent of total potential federal gas production if only wilderness were unavailable	86%	88%	86%	73%	92%

Note that there is additional potential for gas from other formations, but reserves estimates have not been made due to insufficient data. Thus, reserve estimates discussed below represent only those from the Oriskany and associated formations, and not, for example, the Tuscarora Formation, which is currently being drilled and tested on the northern portion of the Forest (USDI, Bureau of Land Management 1989). The estimates represent the potential Oriskany gas production if 37.5 percent or the average of 25 to 50 percent, of the acres available for development within inferred and hypothetical gas resource areas produced natural gas.

Alternative Comparison - Table MI-4 shows how the amount of federally owned gas available for exploration and development affects the potential natural gas production from the federal oil and gas estate within the MNF. Under Alternatives 1, 2, and 2M, there is a 19 percent chance for discovery and production of 195 Bcf and 199 Bcf of natural gas, respectively, due to the minor difference (12,000 more acres in Alternative 2, 2,000 fewer acres in 2M) in federal gas acres available between these alternatives. The percent of the total federal gas potential under Alternatives 1 and 2 reflects this minor difference as well. Table MI-4 shows that under Alternative 3, the acres unavailable (204,000) have resulted in reduced gas production potential of 30 Bcf less than Alternative 1. Under Alternative 3, 73 percent of the total federal gas potential could be produced. Under Alternative 4, which has 31,000 acres more than Alternative 1 available, the most—209 Bcf or 92 percent of the total federal gas potential—gas production could occur as compared to the other alternatives.

The gas production potential figure is lower in Table MI-4 for Alternative 1 than what is shown in the *Current Area Available for Natural Gas Development* section of Table MI-2. This is because the figures used in Table MI-2 include potential gas production from areas that have less than a 19 percent chance of discovery of natural gas. In this analysis, only land that was classified as having a 19 percent chance for natural gas discovery, namely inferred and hypothetical classifications, was used to calculate estimated natural gas production. Areas classified as having speculative Oriskany gas resource potential were not included in estimates of gas production.

Cumulative Effects

Gas Resource

Gas could become unavailable for exploration and development when restrictions on federally owned gas development to protect other forest resources become so numerous that additional costs make gas economically unavailable for exploration and development.

Gas could become unavailable for exploration and development when restrictions on federally owned gas development to protect other forest resources produce many small areas which individually would not make gas unavailable, but could accumulate and form large blocks that would make gas unavailable for exploration and development.

Since federally owned gas is not the only source of gas produced from within the bounds of the MNF, gas could continue to be produced from non-federal minerals even if federally owned gas is unavailable. An indicator of the effect that Forest Plan management would have on potential gas production from the Forest area would be the amount of potential Oriskany natural gas available for production from within the proclamation boundary and purchase units of the MNF. Using the same method as was used to generate the estimates shown in Table MI-5, total Oriskany gas production potential within the MNF proclamation boundary and purchase units is estimated to be 742 Bcf, if only Congressionally designated wildernesses were unavailable.

Table MI-5. Potential Natural Gas Production from the MNF by Alternative in Bcf

Gas Production Potential	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Potential (19 percent chance) for production from within the MNF proclamation boundary	711	714	711	681	725
Percent of total potential gas production from within the MNF proclamation boundary	96%	96%	96%	92%	98%

Table MI-5 indicates that most of the natural gas within the MNF proclamation boundary and purchase units could be produced even if some of federal oil and gas is unavailable due to Forest Plan management strategies. This assumes restrictions on federally owned gas development to protect other Forest resources do not become so numerous that: 1) the costs of gas development make gas economically unavailable for exploration and development; or 2) many small areas which individually would not make gas unavailable, accumulate and form large blocks that would make gas unavailable for exploration and development. It also assumes that federally owned gas that is unavailable for exploration and development will not result in economically infeasible private gas reserves. These assumptions are validated by observation of gas development within the MNF over the past one to two decades. There are no indications that unavailable federally owned gas has resulted in industry declining to explore for or develop privately owned gas.

A variety of factors affecting gas exploration and development within the MNF area suggest that most gas production within the MNF proclamation boundary and purchase units will continue as long as the amount of federally owned gas remains available at or near the levels at which it has been historically. Natural gas demand is strong and prices are high and expected to remain so into the future, due in part to increasing use of natural gas for power generation. In addition, improvements in processing geophysical data collected on the subsurface will allow for more precise delineation of gas targets within the geologically complicated MNF (Nolder Memo 2003). Couple improvement in delineation of gas targets with improved economic and technical feasibility of directional drilling, and the circumstances for gas exploration and production remain favorable, even if some federal gas is unavailable or is available with higher production costs in order to protect MNF resources. It could also mean that federal gas may not always be needed to make gas fields economically feasible in certain areas, especially where there is intermingled federal and private gas ownership.

Gas Development

Increases in natural gas prices normally lead to increases in exploration and development. The complex geology and nature of the gas targets within MNF will act to limit exploration and development to levels described in the Current Condition section as the reasonable foreseeable gas development scenario for the MNF.

As exploration and development occurs, regardless of whether it occurs within federally or privately owned oil and gas estates, it will be subject to applicable West Virginia laws and a variety of federal laws. Development of federally owned gas is additionally conditioned by federal oil and gas lease terms and laws and regulations administered by the BLM. Laws and regulations administered by the Forest Service and the MNF Forest Plan also apply to gas development. In total, gas exploration and development within the MNF is subject to laws, regulations and management direction that conserve the gas resource and protect the environment.

Recreation and Wilderness

INTRODUCTION

The Monongahela National Forest (MNF) holds a key position, both geographically and socially, in the preservation of the mountain ecology and culture important to the Appalachian region. It is revered in West Virginia as a special place. The motto of the State of West Virginia is, "Mountaineers are always free." The mountains of the Monongahela, in a literal sense, define the character of the State embodied in that motto. The Forest consists of the largest expanse of undeveloped public land in West Virginia, and stands in sharp contrast to other areas of the State that have been impacted by extractive industries. In this sense, the Monongahela is a place where nature has been relatively free to exist without industrial intrusion for the past 70 years. In a human sense, the freedom of the mountaineers is represented by the unconfined, unrestricted recreation opportunities available on the Forest, which is a natural and inviting escape for those seeking dispersed or developed recreation in a natural setting.

The national importance of the recreation resource of the Monongahela has been recognized through the designation of the Spruce Knob–Seneca Rocks National Recreation Area (NRA), the first NRA in the Forest Service, National Scenic Byway status for the Highland Scenic Highway, five Congressionally designated Wildernesses, and seven National Natural Landmarks.

The desired condition for recreation management on the Monongahela, as specified in the 2006 Forest Plan, is to offer a wide spectrum of recreational opportunities. The Management Prescriptions (MPs) in the Forest Plan provide for a variety of recreational settings, from semi-primitive backcountry, to roaded areas with motorized access, to developed recreation complexes that include campgrounds, picnic areas, boating facilities, and visitor centers. Dispersed recreation opportunities abound for hiking, backpacking, fishing, hunting, mountain biking, horseback riding, and so on. Developed sites provide the tourism destination facilities and base camps important to the efforts of local convention and visitor bureaus, local communities, and other non-government agencies.

The Monongahela strives to be a good neighbor in our cooperation with surrounding communities and counties. The Forest supports tourism and recreation marketing efforts through partnerships, accessible recreation programs, and recreation opportunities in concert with the ecological capability of the land. This support benefits the economic and social fabric of the small communities that make up our local neighborhood. These efforts help enable the Forest to manage for quality recreation opportunities within the sustainable capabilities of the ecosystem, as in the Vision Statement of the National Recreation Agenda.

Need For Change

One of the major Need For Change topics that helped generate Forest Plan revision for the Monongahela was Backcountry Recreation. When asked to identify issues or concerns for revision during the scoping process, many people focused on opportunities to recreate in a backcountry setting. Some people were supportive of this type of use and wanted to see more opportunities in the future, including large areas of the Forest recommended for Wilderness designation. Others felt that there were more than enough backcountry opportunities on the Forest now, and that Wilderness recommendation and designation would prevent them from using and enjoying the Forest in the traditional ways they have in the past.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect the amount of backcountry recreation areas offered by the Forest, including areas recommended for Wilderness.

Background

The 1986 Forest Plan emphasizes backcountry recreation on approximately 124,500 acres of primarily semi-primitive non-motorized (SPNM) landscapes, as described for MP 6.2. Over 78,000 acres of congressionally designated Wilderness (MP 5.0) also support this type of management emphasis. The combined MP 6.2 and 5.0 areas that emphasize backcountry recreation make up an estimated 22 percent of the Forest.

As one of the six decisions made in Forest Plan revision, the Forest re-inventoried its roadless areas in order to evaluate those areas for wilderness potential. The Roadless Area Inventory process looked at all existing MP 6.2 areas, Roadless Area Review and Evaluation (RARE II) areas, areas inventoried for the Roadless Area Conservation Rule and any area 5,000 acres or greater with less than ½ mile of improved road per 1,000 acres to determine if they qualified as Inventoried Roadless Areas (IRAs). We also reviewed other areas between 1,000 and 5,000 acres and not adjacent to existing Wilderness, but these areas were not evaluated in detail because they typically had a combination of characteristics that resulted in inadequate settings and opportunities for a wilderness experience. These characteristics included narrow or amoeba-like shape, miles of improved roads, and proximity to the sights and sounds of development.

The inventoried areas provide the best opportunities for 6.2 management, as well as the best pool for potential Wilderness recommendations. As there are no recommended Wilderness areas in the 1986 Forest Plan, a new MP (5.1) was created for Forest Plan revision to represent Wilderness Study Areas.

This issue explores the question of whether the current mix of management emphasis associated with backcountry recreation is an appropriate amount and distribution across the Forest. It also looks at how much if any area should be added to that mix in the form of recommended Wilderness. Finally, the analysis explores how backcountry recreation opportunities under each alternative would fit into and affect the overall context of recreation opportunities on the Forest and within the State of West Virginia.

Indicators

The indicators used to measure effects on this issue are:

- Acres of MP 6.2 (Backcountry Recreation) by alternative
- Acres of MP 8.1 SPNM (backcountry recreation within the NRA) by alternative
- Acres of MP 5.1 (Recommended Wilderness) by alternative
- Total Acres of Backcountry Recreation opportunities (5.0, 5.1, 6.2, 8.1 SPNM) by alternative
- Recreation Opportunity Spectrum (ROS) Class distribution by alternative
- Percent contribution to backcountry recreation opportunities in West Virginia by alternative.

Scope of the Analysis

The affected area for direct and indirect effects to recreation opportunities, including backcountry and Wilderness, are the lands administered by the MNF in West Virginia. This area represents National Forest System (NFS) land where backcountry recreation opportunities may occur, depending on MP allocations in the Forest Plan. The affected area for cumulative effects includes all public lands within the State of West Virginia that may provide backcountry recreation opportunities. Cumulative effects of backcountry opportunities on other public lands are addressed to lend a broader perspective to the importance of the opportunities and settings on the Forest. Effects are assessed for the next planning period (10-15 years) but may extend for longer duration, depending on future management or Congressional decisions.

CURRENT CONDITIONS

The affected environment includes an overview of national, regional, and local recreation trends, the ROS, and existing recreation opportunities and facilities available on the Forest.

Leisure and Outdoor Recreation Trends

National Recreation

By far the most popular forms of outdoor leisure are those that can be enjoyed close to home and that do not usually require large outlays of time and money or high levels of specialized skills. These forms of outdoor activity have remained popular for years. Only consumptive activities (such as hunting) have decreased in popularity (Cordell and Overdevest 2001). Based on the 2002 National Visitor Use Monitoring (NVUM) Report, over 214 million visits occurred on NFS land in 2001. Additionally, there were an estimated 215 million occasions of people viewing National Forest scenery from non-Forest Service roads.

Recently, there have been a number of new forms of outdoor recreational activities as well as acceleration in the growth of activities that have been popular for decades. The fastest growing outdoor recreation activities are hiking, backpacking, birding, off-road driving, snowmobiling, downhill skiing, walking, and swimming. New activities are often the result of advances in outdoor equipment technology and an increased interest in risk and sense of adventure. Overall, trends point to much greater interest in viewing and learning activities, trail activities, winter sports, motorized participation, and high technology activities. Among the four regions of the country, growth in recreation participation is highest in the South, next highest in the Northeast, and slowest in the North-Central (Cordell and Overdevest 2001).

The demographic makeup of outdoor recreation participants has been shifting. In part, these shifts reflect changes in the makeup of the U.S. population. However, some demographic changes also represent a shift in group preferences. Across demographic groups, Americans took more trips for outdoor recreation in the 1990s than the 1980s. Across a variety of activities, the percentage of participants who took trips away from home increased from 21 to 37 percent, and the number of trips taken per person has risen dramatically. During recreational trips from home, the number of places visited on the trip has also increased (Cordell et al. 1997). National participation trends among 21 selected outdoor recreation activities from 1983 to 2000 are displayed in Table RE-1.

Table RE-1. National Participation Trends in Outdoor Recreation Activities, 1983-2000
(In millions of participants 16 years and older)

Activity	1983	1995	2000	Change (1983-2000)	Percent Change (1983-2000)
Backpacking	8.8	15.2	27.9	19.1	217%
Bicycling	56.5	57.4	86.2	29.7	53%
Bird watching	21.2	54.1	38.2	17	80%
Boating (overall)	49.5	58.1	76.7	27.2	55%
Camping (developed)	30	41.5	41.3	11.3	38%
Camping (primitive)	17.7	28	25.8	8.1	46%
Cross-country skiing	5.3	6.5	8.8	3.5	66%
Downhill skiing	10.6	16.8	19.3	8.7	82%
Fishing	60.1	57.8	67.9	7.8	13%
Hiking	24.7	47.8	69.8	45.1	183%
Horseback riding	15.9	14.3	23.1	7.2	45%
Hunting	21.2	18.6	20.9	-0.3	-1%
Motorboating	33.6	47	48.2	14.6	43%
Off-road driving	19.4	27.9	35	15.6	80%
Picnicking	84.8	98.3	118.3	33.5	40%
Sailing	10.6	9.6	10.9	0.3	3%
Sightseeing	81.3	113.4	108.6	27.3	34%
Snowmobiling	5.3	7.1	10.7	5.4	102%
Swimming (river, lake, ocean)	56.5	78.1	94.8	38.3	68%
Walking	93.6	133.7	172.3	78.7	84%
Water skiing	15.9	17.9	15.7	-0.2	-1%

National Wilderness

Wilderness is an important component in global health, contributing to clean air and water, protecting ecosystems and gene pools, and helping to regulate world climates. In 1993 there were a total of 3,576,656 square miles of protected areas in the world. This represents about 6.3 percent of the total world land base. Hectares of wilderness represent 9 percent of the total protected areas and 0.6 percent of the total world land base.

Since passage of the Wilderness Act in 1964, the National Wilderness Preservation System has grown from about 9 million acres to 104 million acres in the United States. The National Park Service manages 43 million acres (45%), the Fish and Wildlife Service 21 million acres (20%), the Forest Service 35 million acres (29%), and the Bureau of Land Management 5 million acres (5%). The Forest Service manages an estimated 63 percent of the Wilderness in the lower 48 states, with almost 400 of the 630 units in the system. One acre in six of the National Forest System is now in the National Wilderness Preservation System. Wilderness and the most remote recreational opportunities are heavily concentrated in the Western United States. Due to fewer people and more wild lands, the effective availability of Wilderness and the majority of remote recreational opportunities are about 15 times greater in the West than the East.

National Forest Wilderness recreation use is predicted to grow from about 9 million visits in 1990 to an estimated 24.5 million visits in 2030 (Cordell 1999). Growth in recreation use of Wilderness is expected to be slow to moderate between 1990 and 2010, with an increase of 6 million visits over this 20-year period. The National Forest Visitor Use Monitoring (NVUM) Report indicates that there were 12.7 million visits to NFS-administered Wildernesses in 2002. This number represents about 6 percent of the total Forest Service recreation use. Recreation is one of the many values associated with Wilderness areas. Other values include but are not limited to long-term environmental monitoring, scenic backdrops for tourism, watershed protection, and fish and wildlife refugia.

Regional and Local Recreation

Table RE-2 shows the percentage of U.S. and Regional populations (16 years and older) participating in different types of land-based outdoor recreation activities in 1983 and 1995.

The West Virginia Department of Tourism Annual 2001 Report indicates that 22 million visitors traveled to the State and spent over $3.1 billion dollars, with a total economic impact of $4.86 billion. Included were 8.6 million visitors who stayed overnight, with an average stay of 3.72 days/person. Leisure expenditures were $69.50/person/day. The 2001 Report included:

- The most popular outdoor recreation activities that visitors participated in were: Site-seeing (20%), Visiting Parks (17.8%), Hiking/Mountain Biking (15.5%), Visiting Historic sites (10.1%), Hunting/Fishing (8.6%), and Camping (6.8%).

- Visitors to West Virginia were primarily from the following states: Ohio (16.4%), Virginia (9.3%), Pennsylvania (8.1%) Maryland (7.5%), Kentucky (5.4%), North Carolina (4.9%) and Florida (4.65).

- The top five overnight metropolitan markets were: Washington D.C., Cleveland, Pittsburgh, Charlotte, and Columbus.

- The MNF is within a day's drive of one third of the United States population.

An Economic Impact of Travel on West Virginia from 2000-2004, completed by Dean Runyan and Associates and published in June 2005, indicates that travel in 2004 generated $3.4 billion, which is equivalent to $9.3 million dollars per day. This is an increase of about 65 percent from the $2.2 billion generated in 2000. The study also indicates that 49% of dollars spent was for day travel, 32% for hotels, motel, and resort, 16% for private homes, 2% for vacation homes, and 1% for campgrounds. The Arts, Entertainment and Recreation category generated about $315 million in 2003. The Potomac Highlands Region, which includes most of the Monongahela National Forest, increased from about $195 million in 2000 to about $239 million in 2004.

Table RE-2. National and Regional Participation in Outdoor Recreation Activities, 1983 and 1995

Activity	Percent in 1983 National	Percent in 1983 Regional	Percent in 1995 National	Percent in 1995 Regional
Walking	53%	49%	67%	64%
Sightseeing	46%	41%	57%	54%
Picnicking	48%	40%	49%	45%
Swimming	32%	30%	39%	37%
Fishing	34%	39%	29%	32%
Boating (overall)	28%	24%	29%	29%
Bicycling	32%	27%	29%	25%
Bird watching	12%	27%	8%	26%
Motorboating	19%	18%	24%	24%
Hiking	14%	9%	24%	19%
Camping (developed)	17%	14%	21%	17%
Camping (primitive)	17%	14%	21%	17%
Off-road driving	11%	9%	14%	15%
Hunting	12%	15%	9%	11%
Water skiing	9%	10%	9%	9%
Horseback riding	9%	8%	7%	7%
Downhill skiing	6%	3%	8%	6%
Backpacking	5%	3%	8%	6%
Sailing	6%	4%	5%	4%
Snowmobiling	3%	0%	4%	1%
Cross-country skiing	3%	0%	3%	1%

The 2001 visitor survey (Shifflet 2002) indicates that one of the primary attractions of West Virginia is outdoor recreation activities, while areas of concern identified by visitors are the quality of restaurants and accommodations.

The MNF provides over 50 percent of the public land available for outdoor recreation in the State of West Virginia.

In 2001 over one million hunting and fishing licenses provided over $15.5 million in revenues to the State, including 71,201 conservation stamps to non-residents.

There are 9 State forests and 41 State parks totaling over 200,000 acres in West Virginia. In general, State managed parks have significant development and provide more developed recreation and leisure activities than most MNF facilities. Some State parks and forests have fairly large tracts of lands that currently offer backcountry recreation opportunities in a natural setting. However, the vast majority of these lands are available for timber harvest and other revenue-generating activities for the State.

Regional and Local Wilderness

As the remainder of the country becomes increasingly populated, it is reasonable to assume that the relatively uncrowded State of West Virginia will become more attractive for those seeking to recreate in a more remote and natural setting.

In West Virginia, NFS lands, and to a lesser extent State lands, are almost the exclusive providers of public SPNM recreation opportunities.

Designated Wilderness (MP 5.0) - The MNF contains five Wildernesses totaling over 78,000 acres, or about 8.6 percent of the entire Forest. Only Congress can create or change Wilderness status; therefore, all alternatives have the same amount of Designated Wilderness. Table RE-3 shows the official acres for each Wilderness as described in the 1986 Plan.

Table RE-3. Designated Wilderness for all Alternatives

Wilderness	Cranberry	Dolly Sods	Laurel Fork North	Laurel Fork South	Otter Creek	Total
Acres	35,864	10,215	6,055	5,997	20,000	78,131

For Forest Plan revision, we have consistently measured Dolly Sods to have about 550 acres more than the official figure shown above. We believe this is likely due to a mapping error that occurred when this area was originally designated. Apparently, the Scenic Area and General Forest Area within the Wilderness boundary were included in the original official acreage but two Special Areas (Fisher Spring Run Bog and Rohrbaugh Plains Bog) were not. These two areas comprise approximately 550 acres. We feel that because these areas are inside the Wilderness boundary they should be acknowledged and managed as Wilderness, so we have included them in our wilderness-related calculations for Forest Plan revision. Thus, the MP 5.0 acres are measured and rounded to 78,700, even though the official Wilderness acres are 78,131.

National Visitor Use Monitoring (NVUM) was completed on the Forest from October 1, 2002 to September 30, 2003. The results indicate an estimated 38,590 visits to the five Wildernesses on the Forest, which is about 3 percent of the total recreation use.

Semi-Primitive Non-Motorized (SPNM) Opportunities - There are currently 78,700 acres of the Forest in MP 5.0 (Designated Wilderness) and roughly 124,500 acres in MP 6.2 (Backcountry Recreation). Both of these prescriptions emphasize SPNM recreation opportunities, and together they represent about 22 percent of the Forest's land base.

Recreation Opportunities and Facilities on the Monongahela National Forest

The MNF is a major outdoor recreation attraction in the State of West Virginia. Visitor use estimates indicate that the Forest received about 1.3 million visits in fiscal year 2003. The Forest provides over 50 percent of the forested public recreation lands in the State of West Virginia. Forest Plan revision does not identify any major new developments, although existing facilities may be rehabilitated or reconstructed to meet visitor expectations and demand, correct health and safety issues, and provide accessible facilities. Many of the Forest's recreation facilities and activity units are listed in Table RE-4.

Table RE-4. Recreation Facilities and Activity Units on the Forest

Facility, Unit, or Activity	Number
Campgrounds	29
Picnic Areas	14
Information/Observation Sites	24
Trailheads	79
Developed Fishing Sites	4
Cabins	1
Visitor Centers	2
Developed Dispersed Sites	44
Scenic Highway	1
General Forest Areas (Concentrated Use Areas)	60
General Forest Areas (Individual Sites)	250
Caves	257
Significant Caves	11
Wilderness Areas	5
Official Wilderness Acres	78,131
Trails (total miles)	852
Trails (miles in Wilderness)	148
Trails (miles of motorized)	0
Recreation Special Uses	78
Eligible Wild and Scenic Rivers	12
Eligible Wild and Scenic Rivers (miles)	260

Recreation activity participation statistics in Table RE-5 are the results of the NVUM Program. The numbers are averages based on surveys completed on the MNF in fiscal year 2003. Only the top 10 activities have been listed.

Table RE-5. Most Popular Recreation Activities on the Forest

Activity	Percent Participation
1. Viewing Natural Features (scenery, flowers, etc)	59%
2. Viewing Wildlife, Birds	55%
3. Hiking/Walking	47%
4. General/ Other (relaxing, hanging out, escaping noise and heat)	46%
5. Driving for Pleasure	35%
6. Fishing	26%
7. Nature Center Activities	20%
8. Camping, Developed Sites	15%
9. Picnicking	15%
10. Downhill Skiing	11%

Note. Bicycling (mountain biking) was 5.1%, and horseback riding was 0.25%.

The Recreation Opportunity Spectrum (ROS) is a national recreation-planning framework that combines physical, social, and managerial settings to help define a range of outdoor recreation conditions, activities and opportunities. Table RE-6 summarizes the general recreation opportunities and settings expected by ROS Class. Complete descriptions are located in the 1982 ROS Planning Guide, pages 6-8.

Table RE-6. ROS Class Setting Descriptions

ROS Class	Description of Recreation Opportunity Setting
Primitive (P)	Very high probability of solitude, closeness to nature, challenge and risk; essentially unmodified natural environment; minimal evidence of others; few restrictions evident; non-motorized access and travel on trails or cross country.
Semi-Primitive Non-Motorized (SPNM)	High probability of solitude, closeness to nature, challenge and risk; predominantly natural or natural-appearing environment; some evidence of others; minimum of subtle, on-site controls; non-motorized access and travel on trails, some primitive roads or cross-country.
Semi-Primitive Motorized (SPM)	Moderate probability of solitude, closeness to nature, and degree of challenge and risk when using or not using motorized equipment; predominantly natural-appearing environment; few users but evidence on trails; minimum of subtle, on-site controls.
Roaded Natural (RN)	Opportunity to be with other users in developed sites, little challenge or risk; predominantly natural-appearing environment as viewed from sensitive roads and trails with moderate evidence of human sights and sounds; moderate concentration of users at campsites; some obvious user control; access and travel is standard motorized vehicles; resource modification and utilization practices are evident but harmonize with the natural environment.
Roaded Modified (RM)	Opportunity to get away from other users, easy access, little challenge or risk; substantially modified environment (roads, timber harvest units, slash, etc.); little evidence of other users except on roads; little regulation of users except on roads; standard motorized use.
Rural (R)	Opportunity to be with others is important as is facility convenience; little challenge or risk except for activities like downhill skiing; natural environment is culturally modified; high interaction among users; obvious on-site controls; access and travel facilities are for intensified motorized use.

ROS Class	Description of Recreation Opportunity Setting
Urban (U)	Opportunity to be with others is very important as is facility and experience convenience, challenge and risk are unimportant except for competitive sports; urbanized environment that may have a natural appearing backdrop; high interaction among large number of users; intensive on-site controls; access and travel facilities are highly intense motorized use often with mass transit supplements.

The current inventory of ROS makeup (based on 2003 inventory for Forest Plan revision) of NFS land on the Forest is described in Table RE-7 below.

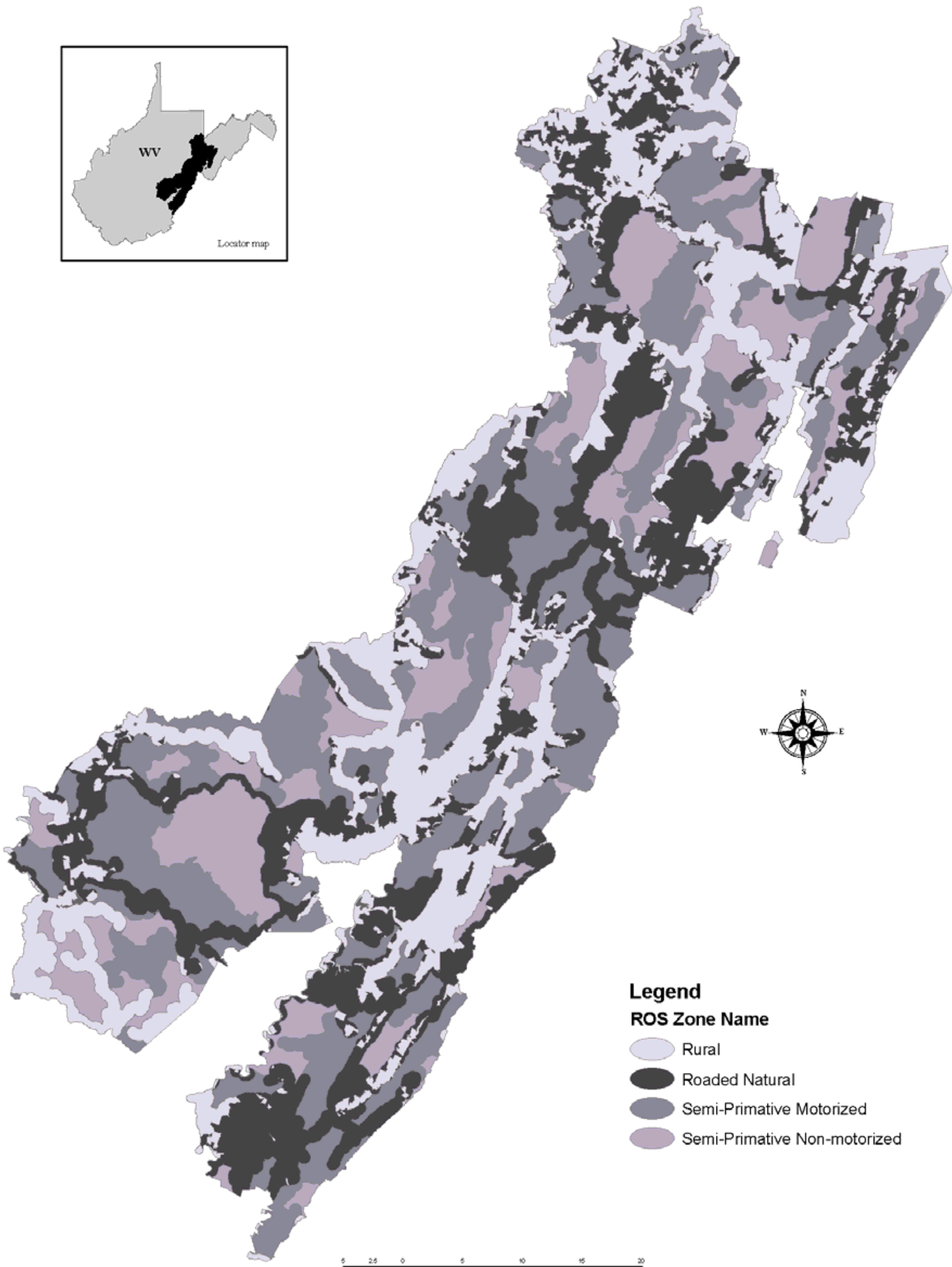
Table RE-7. Current Inventoried ROS Acres on the Forest

ROS Class	Primitive	Semi-primitive Non-Motorized	Semi-primitive Motorized	Roaded Natural	Rural	Urban
Acres	0	188,000	318,000	401,000	8,000	20
Percent of Forest	0%	21%	35%	44%	<1%	<1%

The Monongahela Forest's ROS Inventory currently has little if any lands that qualify as Primitive or Urban under the descriptions below, and only 8,000 acres that are classified as Rural. An estimated 79 percent of the Forest is currently inventoried in ROS Classes that are either Roaded Natural (RN) or Semi-Primitive Motorized (SPM). However, the SPM areas typically have roads that are not open for public motorized use for a variety of reasons, but usually due to wildlife habitat concerns. The estimated 56 percent of the Forest that is classified as SPNM or SPM offer semi-primitive recreation opportunities in settings where motorized use is either absent or very low.

Figure RE-1 displays the current ROS classes on the Forest, representing the existing conditions of the ROS settings described in Table RE-6, above. The map shows all lands within purchase units and the proclaimed boundary of the Forest, including private lands, which are primarily depicted by the Rural ROS Class. As noted in Table RE-7, there are only about 8,000 acres of Rural settings on NFS land within the Forest boundaries. Thus, almost all of the Rural settings (lightest shade on the map) are on private lands.

Figure RE-1. Current ROS Classes Within the Monongahela Forest Boundaries



Backcountry Recreation, Inventoried Roadless Areas, and Wilderness

There are currently an estimated 80,858 acres of federally designated Wilderness in West Virginia, including five areas totaling 78,131 acres on the MNF and an estimated 2,727 acres in the Mountain Lake Wilderness administered by the George Washington and Jefferson National Forest in Virginia. An estimated 124,500 acres are in MP 6.2. Management Prescription 6.2 is managed primarily for SPNM recreation opportunities. There are also 123,629 acres of the George Washington and Jefferson National Forests located in West Virginia, with an estimated 12,400 acres currently being managed for SPNM recreation opportunities.

Table RE-8 identifies the areas and acres that are currently being managed primarily for Remote Backcountry Recreation (SPNM). The acres in this table are slightly different than the acres reported for Alternative 1 in the Environmental Consequences section because the acres in the Environmental Consequences section have been rounded off to the nearest 100 acres.

Table RE-8. Backcountry Recreation Areas Under the 1986 Forest Plan

Remote Backcountry Areas (MP 6.2)	Acres
North Fork/Hopeville	4,637
Flat Rock/Roaring Plains	7,772
Cheat Mountain	7,527
Seneca/Gandy Creek	19,644
East Fork of Greenbrier	7,637
Laurel Fork	3,151
Canaan Mountain	13,532
Smoke Hole	2,670
Little Mountain	10,407
Peters Mountain	2,350
Tea Creek Mountain/Turkey Mountain	10,358
Cranberry Backcountry	7,890
Spice Run	7,698
Big Draft	8,006
Upper Middle Mountain	8,175
Laurel Run	3,037
Total MP 6.2 (13.5% of Forest)	124,491
Designated Wilderness (MP 5.0)*	**Acres***
Cranberry Wilderness	35,900
Dolly Sods Wilderness	10,800
Laurel Fork North Wilderness	6,000
Laurel Fork South Wilderness	6,000
Otter Creek Wilderness	20,000
Total Wilderness Acres (8.6% of Forest)	78,700
Total Acres Managed Primarily for Backcountry Recreation Opportunities on the Monongahela NF (22% of Forest)	**203,200**

*Total acres for Wilderness in 1986 were given at 78,131. However, GIS technology now measures the total to be closer to 78,700 (see explanation on page 3-387). We have chosen to use the updated numbers for consistency with the other GIS generated numbers that we are using in plan revision.

ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Below are the mitigation or management requirements common to all alternatives that will be used to protect recreation resources and areas, including Wilderness and Backcountry Recreation. Resource protection methods come in the form of laws, regulations, policies, FSM and FSH direction, and Forest Plan direction.

Laws, Regulations, and Policies

Numerous laws, regulations, and policies govern the management of recreation resources on NFS land. National laws and regulations have also been interpreted for implementation in Forest Service Manuals, Handbooks, and Regional Guides. All recreation management activities and facilities must comply with these laws, regulations, and policies, which are not only intended to provide general guidance for implementation, but also protection of recreation-related resources. Some of the more influential laws, regulations, and policies governing recreation management on federal lands are referenced in Table RE-9.

Table RE-9. Major Laws and Regulations Influencing Management and Protection of Recreation Resources on the Forest

Act/Law/Regulation/Policy	Date	Law/CFR/FSM/FSH Number
Organic Administration Act	06/04/1897	30 Stat. 11
Weeks Law	03/01/1911	P.L. 61-435
Granger-Thye Act	04/24/1950	P.L. 81-478
Wilderness Act	09/03/1964	P.L.88-577
Land and Water Conservation Fund Act	09/03/1964	P.L. 88-578
Architectural Barriers Act of 1968	08/12/1968	P.L. 90-480
Wild and Scenic Rivers Act	10/02/1968	P.L. 90-542
National Trails System Act	10/02/1968	P.L. 90-543
Volunteers in the National Forests Act of 1972	05/18/1972	P.L. 92-300
Eastern Wilderness Act	01/03/1975	P.L. 93-622
Code of Federal Regulations for Recreation, Wilderness, and Trail Resources		36 CFR 219.21
General Prohibitions		36 CFR 261
Forest Service Manual, Recreation, Wilderness and Related Resource Management	Updated as needed	FSM 2300
Forest Service Handbook, Recreation, Wilderness and Related Resource Management	Updated as needed	FSH 2300

Forest Plan Direction

Forest Plan direction for the management and protection of recreation resources occurs at two levels, Forest-wide and Management Prescription. For Forest Plan revision, Forest-wide direction has been expanded to include additional goals, and a clearer description of desired conditions. Objectives, standards, and guidelines have also been rewritten in some instances to provide more concise and clearer direction, and better integration between recreation and other resources. Some 1986 Forest Plan direction has been removed, including items that were process-oriented, or that were repeating existing law or policy, or that conflicted with other resource management. In addition, the Forest will use the ROS system and Scenery Management System (SMS) on a Forest-wide basis to integrate recreation and visual concerns into all Forest management activities.

Direction for all MPs will be applied to help ensure that appropriate recreation settings and opportunities are provided for a wide range of uses and activities. MPs 6.2 and 7.0 are specifically designed to provide areas were recreation resources and uses are emphasized. Management Prescription 6.2 (Backcountry Recreation) emphasizes dispersed recreation opportunities in a predominantly SPNM ROS setting. Management Prescription 7.0 (Developed Recreation) occurs in the 1986 Forest Plan and Alternative 1, but was dropped in the 2006 Forest Plan and incorporated into other prescriptions in Alternatives 2 through 4. It was felt that these relatively small recreation complexes would be managed for developed recreation regardless of which MP encompassed them.

Management Prescriptions 5.0 (Designated Wilderness) and 5.1 (Recommended Wilderness) can also be said to have a recreation emphasis, as recreation is the primary use or activity that is managed within them. These prescriptions contain direction to manage recreation settings to their ROS classifications, to protect recreation resources, and to protect other resources from recreation activities.

<u>**Forest Plan Implementation**</u>

Almost all management activities and uses of the Forest have the potential to alter recreation settings, resources, and experiences. As a result, effects on the following recreation elements will be assessed during all project proposal analyses:

ROS Classification – Project proposals will be evaluated relative to their consistency with the ROS strategy and maps for the Forest. In most cases, projects will be designed to maintain or enhance the desired ROS classification. When a deciding official accepts a project that is not consistent with the ROS strategy, a determination is made as to whether the effects of the project to the ROS strategy warrant a Forest Plan amendment. The full effects of either of these outcomes will be analyzed.

Recreation Improvements and Developments - Proposed resource projects will be designed to protect developed recreation sites, National Forest System trails, and their associated high-quality recreation experiences. Avoidance of developed sites and improvements during site-disturbing activities will be the preferred mitigation. Facility and trail re-location, decommissioning, or closure may be other options in cases of overriding developments.

Dispersed Use – Potential effects on dispersed recreation experiences will be analyzed during new project design and analysis. When possible, adjustments to proposed activities and uses to protect dispersed recreation experiences will be the preferred mitigation.

Effects Common to All Alternatives

Recreation-related Effects Common to All Alternatives

Recreation opportunities occur on virtually every acre on NFS land. Given this, almost every management activity, as well as a wide array of disturbance events, can potentially affect recreation opportunities and experiences. Effects on these opportunities and experiences are generally the result of changes to recreation settings or level of access, or both. The relative amount of these effects may, in some cases, vary by alternative. However, they are likely to be present to some extent in all alternatives.

Effects from obvious development activities—such as timber harvest, road construction, mineral development, or special use facility construction—are potentially the greatest in areas where no evidence of such activities previously exists. The intensity of the effects also varies greatly with the intensity of the development activity. Concentrated even-aged harvests have a much greater impact on recreational settings, for example, than dispersed individual tree selection cuts. Short-term and temporary effects are created by all such activities during development operations. Effects can include increased noise and dust levels, and increased use of narrow back roads by large equipment and vehicles. Most users are displaced to other locations during these active operation periods. Facility development typically creates long-term effects to recreation settings.

Development with associated road construction also improves access to an area, which can lead to increased use, and displacement of some users who prefer less developed settings and more primitive opportunities. These shifts in opportunities can be long term, as roads are typically long-lasting features. However, actions such as road closures, decommissioning, or travel restrictions can mitigate these shifts to some extent.

Development activities can also have beneficial effects to recreationists. Timber harvests can remove dead and diseased trees, and add diversity to the visual landscape over the long term. They can also provide firewood-gathering opportunities. Improved roads and campgrounds can increase user comfort and safety. New roads and trails can facilitate access into areas for recreation, or create new opportunities for motorized recreation. Prescribed burning can have the temporary effect of displacing users, but it can also reduce understory vegetation and improve sight distances, settings, and off-trail access over the short and long term.

In addition, general effects to and from the Forest's recreation program are highlighted below.

Recreation System Planning - Recreation system planning will continue to emphasize semi-primitive forms of recreation requiring a large land base, and developed sites will continue to be provided to support that use where the private sector is unlikely to meet visitor demand. The ROS system will be the primary tool used for all recreation planning. Recreational settings will be managed to provide a mix of recreation opportunities, protect natural resource values, and promote visitor safety.

Developed Recreation - The Forest will give priority to the rehabilitation and upgrading of existing sites and provide additional recreation facilities where needed and the private sector is not likely to meet the demand. Developed sites will be designed to compliment adjacent ROS settings. Accessible facilities are provided based on the ROS setting and development scale for the area.

General Forest Environment Areas - Management of general forest areas will remain consistent with the 1986 Forest Plan management direction. Camping will be limited to 14 days in a specific location unless approved by the line officer. Dispersed camping will be permitted unless resource damage or visitor conflicts cannot be mitigated. Unacceptable or irresolvable activities may be prohibited by a closure order. Facilities are permitted but will be consistent with the ROS class. Caves are available for public recreation unless prohibited or restricted by a closure order.

Trails - A system of trails that supports a wide variety of recreation opportunities and settings continues to be a goal. The maintenance and/or relocation of existing trails should take priority over new trail construction. The 2006 Forest Plan has a new objective to develop a Forest-wide trail management plan to establish trail classes, permitted uses, and construction, reconstruction, and maintenance priorities. This trail planning is scheduled to occur in 2005 and 2006.

Scenery Management and Recreation Opportunity Spectrum - Landscape Aesthetics, The Scenery Management System Handbook will replace the National Forest Landscape Management Handbook as the primary tool use to manage scenery and landscapes across the Forest. Because the Forest was mapped by scenery concern levels (high, medium, and low) and not by MP, the Scenic Integrity Objectives do not change by alternative. Site-specific scenic effects will be analyzed on a project-level basis. The ROS will continue to be used as the primary tool to manage recreation opportunities and settings across the Forest.

Recreation Special Uses - Recreation special use permit applications will continue to be considered, analyzed, processed and administered consistent with national policy, management direction, and Forest protocols.

Spruce Knob-Seneca Rocks National Recreation Area (NRA) - The NRA will continue to be managed in accordance with the Act of September 28, 1965, with an emphasis to provide a range of high quality recreation opportunities in the appropriate Rural, RN, and SPNM ROS settings. Existing and desired future ROS conditions can be used to manage the area over time.

Effects to Backcountry Recreation Opportunities

Applied to any alternative, MPs 5.0, 5.1 and 6.2 would provide high-quality backcountry recreation opportunities in a SPNM setting. The same can be said for SPNM areas within MP 8.1 (the NRA). Trail systems in most areas facilitate challenging activities such as hiking, backpacking, mountain biking, hunting, orienteering, and equestrian use. Rivers and creeks provide fishing and float-boating opportunities. Tent camping may generally occur throughout these areas with some local restrictions for resource protection.

Other signs and sounds of development activities are generally low to non-existent. Facilities and structures are generally prohibited or absent. Programmed commercial timber harvest and road construction are typically not allowed. For the most part, ecological processes would affect vegetation, although some prescribed burning or low-level restoration treatments could occur under MPs 6.2, 5.1, and 8.1 SPNM. Any treatments would have to be designed so that they do not alter the overall undeveloped character of the area. For those seeking a natural setting in which to recreate, the lack or scarcity of management would be a benefit. However, the vegetation would likely trend toward a decrease in age class diversity and an increase in age, density, and fuels, resulting in increased insect and disease activity, which could negatively affect the visual landscape.

Public motorized use would not occur. Very low levels of intermittent administrative motorized use may occur in MPs 5.1, 6.2, and 8.1 SPNM areas. The amount of NFS lands in 5.0, 5.1, 6.2, and 8.1 SPNM MPs indirectly affects the amount of NFS lands that are available for public motorized use elsewhere on the Forest.

Range allotments and cattle grazing are largely non-existent in current and proposed backcountry recreation areas. Mineral exploration and development have been withdrawn from MP 5.0 areas, although these activities may occur in MPs 5.1, 6.2, and 8.1 areas, particularly where mineral rights are privately owned. Federal gas and oil leasing is subject to a no surface occupancy stipulation that would greatly reduce the potential for surface disturbance from mineral activities. Special use authorizations may occur but should be designed to be consistent with the recreation emphasis and direction of the area. Watershed and most wildlife management improvements are generally small and localized, and would have a negligible effect on undeveloped character or wilderness attributes. Maintained wildlife openings may have an impact, particularly during maintenance operations.

All of the above effects are assumed to be long term, in that the prescription allocations should last at least through the planning period, 10-15 years, and potentially much longer. It is possible that Congress could designate MP 5.1 areas, or even some MP 6.2 areas, as Wilderness during this period. However, this designation would not substantially change the landscape character or resource protection provided by the current prescriptions. Designation, however, would affect certain uses or forego potential values. For example, bicycling would be considered a non-conforming use, and any potential value from timber harvest or federal mineral leasing would not be realized.

Direct and Indirect Effects by Alternative

Effects to Backcountry Recreation Opportunities

This assessment focuses on those areas that, based on their overall size and management emphasis, would provide the best opportunity for backcountry recreation on the Forest. They are divided into three MP categories below: 6.2, 8.1 SPNM areas, and 5.1.

Management Prescription 6.2

Table RE-10. MP 6.2 Areas by Alternative

Alternative 1		Alternative 2		Alternative 2M		Alternative 3		Alternative 4	
Area	**Acres**	**Area**	**Acres**	**Area**	**Acres**	**Area**	**Acres**	**Area**	**Acres**
Big Draft	8,006	Big Draft	5,395	Big Draft	5,395	Big Draft	2,611	Cheat Mtn.	7,955
Canaan Mountain	13,532	Canaan Loop	7,850	Canaan Loop	7,850	Beaver Lick Mountain	18,611	Cranberry Expansion	12,165
Cheat Mountain	7,527	Dolly Sods North	7,215	Dolly Sods North	7,215	Canaan Mountain	13,532	Dolly Sods North	7,215
Cranberry Backcountry	7,890	East Fork Greenbrier	10,153	East Fork Greenbrier	10,153	Cranberry Backcountry	5,127	Dry Fork	739
East Fork of Greenbrier	7,637	Gaudineer	6,727	Gaudineer	6,727	Dolly Sods North	7,215	Roaring Plains North	3,119
Laurel Fork	3,151	Gauley Mtn. East	7,780	Gauley Mtn. East	7,780	Falls of Hills Creek	5,474	Roaring Plains West	6,825
Laurel Run	3,037	Gauley Mtn. West	6,624	Gauley Mtn. West	6,624	Gaudineer	6,773	Seneca Creek	13,001
Little Mountain	10,407	Middle Mountain	12,197	Lower Laurel Fork	3,177	Gauley Mtn. East	7,780		
North Fork/ Hopeville	4,637	Seneca Creek	13,001	Middle Mountain	12,197	Gauley Mtn. West	6,624		
Upper Middle Mountain	8,175	Spice Run	6,171	Roaring Plains North	3,119	Glady Fork	2,759		
Peters Mountain	2,350	Tea Creek Mountain	8,272	Roaring Plains East	2,962	Greathouse Hollow	9,729		
Flat Rock/ Roaring Plains	7,772	Turkey Mountain	6,111	Seneca Creek	13,001	Kennison Mountain	23,717		
Seneca Creek/ Gandy Creek	19,644			Spice Run	6,171	Laurel Fork	1,172		
Smoke Hole	2,670			Tea Creek Mountain	8,272	Laurel Run	3,032		
Spice Run	7,698			Turkey Mountain	6,111	Little Allegheny	6,155		
Tea Creek/ Turkey Mtn.	10,358					Little Mountain	8,072		
						Lockridge Mtn. North	8,169		
						Lockridge Mtn. South	6,541		
						Lower Laurel Fork	3,177		
						Marlin Mtn.	9,347		
						McGowen Mtn.	10,522		
						Meadow Creek North	9,682		
						Meadow Creek South	5,465		
						Middle Mtn.	12,197		
						Peters Mtn.	2,347		
						Roaring Plains East	2,962		
						Roaring Plains North	3,199		
						Spice Run	1,527		
						Tea Creek	8,272		
						U. Shavers Fork East	8,218		
						U. Shavers Fork West	5,975		
Areas	**16**	**Areas**	**12**	**Areas**	**15**	**Areas**	**31**	**Areas**	**7**
Total Acres*	**124,500**	**Total Acres**	**97,500**	**Total Acres**	**106,800**	**Total Acres**	**225,900**	**Total Acres**	**51,000**

*Rounded to the nearest 100

MP 6.2 areas emphasize backcountry recreation in a SPNM setting. Direction for these areas includes numerous constraints on management actions in order to maintain undeveloped character and backcountry recreation opportunities. Evidence of development is expected to be very low. The MP 6.2 allocations vary by alternative as seen in Table RE-10.

Alternative 1 - Allocations for the No Action Alternative 1 are based on the 1986 Forest Plan MP 6.2 allocations (see Table RE-8), and total 124,500 acres.

Alternative 2 – Allocations are based on a new Roadless Area Inventory that was conducted as part of the Need for Change in Forest Plan revision (see Appendix C to the EIS). The new inventory identified the 16 IRAs shown in Table RE-11 in the DEIS. Four of the 2006 IRAs are assigned the 5.1 MP (see Recommended Wilderness section). Eleven of the 2006 IRAs are assigned the 6.2 MP under this alternative. The remaining IRA is Seneca Creek. The portion of the Seneca Creek IRA outside of the NRA (13,001 acres) is assigned a 6.2 MP. The portion within the NRA 8.1 MP would be managed as SPNM, with similar management direction as 6.2. In addition, the North Fork Mountain (9,391 acres) and Smoke Hole (3,567 acres) areas, which did not qualify for the 2006 inventory, would also be managed as SPNM within the 8.1 MP.

A number of areas managed as MP 6.2 in the 1986 Forest Plan have been assigned a different MP under this alternative. Peters Mountain, (2,350 acres), Little Mountain (10,404 acres), Lower Laurel Fork (3,151 acres), and Laurel Run (3,037 acres) are assigned a 6.1 MP, and Roaring Plains North (3,119 acres) and Cranberry Backcountry (7,890 acres) are assigned a 4.1 MP. Roaring Plains East (2,962 acres) is assigned a combination of MP 4.1 and MP 6.1. However, MP 6.2 also has several new areas that were not in the 1986 Plan, including Dolly Sods North (7,215 acres), Gaudineer (6,727 acres), Gauley Mountain East (7,780 acres), and Gauley Mountain West (6,624 acres).

Alternative 2 Modified – Alternative 2 was modified between the Draft and Final EIS based on public comments to create Alternative 2M. Thus, Alternative 2M has all of the 6.2 and 8.1 SPNM areas as Alternative 2, plus three additional areas. Roaring Plains North and Roaring Plains East were added to the Roadless Area Inventory and assigned a 6.2 MP. Although each of these areas is well under 5,000 acres, they are located on a high-elevation plateau where the sights and sounds of nearby development would be moderated by the topography. They are also buffered from development to the south and west by Roaring Plains West and to the north by Dolly Sods Wilderness. Lower Laurel Fork did not qualify for the Roadless Area Inventory, but is assigned a 6.2 primarily because of the eligible Wild and Scenic River corridor that occupies much of the area. These three areas add over 9,200 acres to MP 6.2 in Alternative 2M compared to Alternative 2.

Alternative 3 - Because this alternative emphasizes backcountry recreation, it includes the maximum potential acres and areas of MP 6.2 based on the 1986 Forest Plan areas, the 2006 Roadless Area Inventory described above in Alternative 2, and areas identified by interest groups as potential roadless areas. Eleven of the 2006 IRAs are assigned MP 5.1 (see Recommended Wilderness section) and seven of the 2006 IRAs are assigned the 6.2 MP under this alternative. In addition, the North Fork Mountain and Smoke Hole areas, which are not in the 2006 Inventory, would be managed as a SPNM ROS classification within the 8.1 MP. Areas managed as MP 6.2 in the 1986 Forest Plan that were not included in the 2006 Inventory include Peters Mountain, Laurel Fork, Little Mountain, Cranberry Backcountry, and Laurel Run, but they would be managed as MP 6.2 under Alternative 3. Additional areas are listed in Table RE-10.

Alternative 4 – This alternative emphasizes vegetation restoration and has the least amount of MP 6.2 because it does not include any of the 1986 areas that did not qualify for the 2006 roadless inventory. Seven (Cheat Mountain, Cranberry Expansion, Dolly Sods North, Dry Fork, Roaring Plains North, Roaring Plains West, Seneca Creek) of the eighteen 2006 IRAs are assigned MP 6.2 under this alternative. No areas are assigned MP 5.1 (see Recommended Wilderness section, below). The breakdown for the remaining 12 IRAs is a follows; three areas (Middle Mountain, Big Draft, Spice Run) are assigned a 6.1 MP, seven (Canaan Loop, Gaudineer, Gauley Mountain East, Roaring Plains East, East Fork Greenbrier, Tea Creek, Turkey Mountain) are assigned a 4.1 MP, and one area (Gauley Mountain West) is assigned 3.0 MP. The remaining IRA is Seneca Creek, which would be managed as MP 6.2 outside of the NRA and as MP 8.1 SPNM within the NRA. In addition, the North Fork Mountain and Smoke Hole areas, which are not on the 2006 Inventory, would also be managed as SPNM within 8.1.

Management Prescription 8.1 SPNM

A minor Need For Change identified for Forest Plan revision was assigning the Spruce Knob – Seneca Rocks National Recreation Area (NRA) its own Management Prescription in order to highlight its national, regional, and local importance. Thus, under the action alternatives, the NRA has an 8.1 MP, but under the No Action Alternative it is represented by a mix of MPs.

The action alternatives also have MP 8.1 SPNM areas that emphasize backcountry recreation in a SPNM setting. Management direction for these areas includes numerous constraints on management actions in order to maintain undeveloped character and backcountry recreation opportunities. Evidence of development is expected to be very low, and the areas would be managed similarly to MP 6.2 (see management direction for MP 8.1 SPNM in the 2006 Forest Plan). The MP 8.1 SPNM allocations vary somewhat by alternative as seen in Table RE-11.

Table RE-11. MP 8.1 SPNM Acres by Alternative

Alternative 1		Alternative 2		Alternative 2M		Alternative 3		Alternative 4	
Area	**Acres**	**Area**	**Acres**	**Area**	**Acres**	**Area**	**Acres**	**Area**	**Acres**
None	0	Seneca Creek	11,973	Seneca Creek	11,973	North Fork Mountain	9,391	Seneca Creek	11,973
		North Fork Mountain	9,391	North Fork Mountain	9,391	Smoke Hole	3,567	North Fork Mountain	9,391
		Smoke Hole	3,567	Smoke Hole	3,567			Smoke Hole	3,567
Total Acres	**0**	**Total Acres**	**24,900**	**Total Acres**	**24,900**	**Total Acres**	**13,000**	**Total Acres**	**24,900**

Alternative 1 – The NRA does not have a separate prescription under Alternative 1, so the SPNM areas within the NRA have their original 6.2 MP allocation and are described under the MP 6.2 section below.

Alternatives 2, 2M, and 4 - MP 8.1 SPNM allocations for these alternatives are based on the three areas within the NRA that have a 6.2 MP under the 1986 Plan. Both North Fork Mountain and Smoke Hole have expanded acres compared to the 1986 Plan areas. Thus there are about 5,700 more acres that emphasize backcountry recreation in the NRA under Alternatives 2 and 2M than under Alternative 1, which represents the 1986 Plan as amended.

Alternative 3 – This alternative has two areas in MP 8.1 SPNM, totaling around 13,000 acres. The Seneca Creek area is assigned a 5.1 MP (Recommended Wilderness) under Alternative 3. Both North Fork Mountain and Smoke Hole have expanded acres compared to the 1986 Plan areas. Thus there are about 5,700 more acres that emphasize backcountry recreation in the NRA under Alternatives 3 and 4 than in Alternative 1.

Management Prescription 5.1 (Areas Recommended for Wilderness Study)

Recommended Wilderness by Alternative - MP 5.1 emphasizes maintaining wilderness character in a SPNM setting. Direction for this MP includes strong constraints on management actions that could enhance the SPNM setting or the wilderness character of each area. Evidence of development is expected to be extremely low. Although MP 5.1 does not prohibit certain activities that may be considered non-conforming under a wilderness designation, like mountain biking or wildlife opening maintenance, this allocation may increase the likelihood that these areas are eventually designated by Congress, at which time prohibitions or restrictions would apply. Appendix C includes a general effects assessment of a Wilderness vs. a non-Wilderness designation. The MP 5.1 allocations were made from the pool of the 18 Inventory Roadless Areas listed in Table RE-13. The allocations vary by alternative as seen in Table RE-12.

Table RE-12. Recommended Wilderness (MP 5.1) Areas by Alternative

Alternatives 1 and 4		Alternatives 2 and 2M		Alternative 3	
Area	Acres	Area	Acres	Area	Acres
None	0	Cheat Mountain	7,955	Big Draft	5,395
		Cranberry Expansion	12,165	Cheat Mountain	7,955
		Dry Fork	739	Cranberry Expansion	12,165
		Roaring Plains West	6,825	Dry Fork	739
				East Fork Greenbrier	10,153
				Gaudineer	6,727
				Middle Mountain	12,197
				Roaring Plains West	6,825
				Seneca Creek	24,974
				Spice Run	6,171
				Turkey Mountain	6,111
Areas	**0**	**Areas**	**4**	**Areas**	**11**
Total Acres	**0**	**Total Acres**	**27,700**	**Total Acres**	**99,400**

Alternative 1 – The No Action alternative represents no change from the 1986 Forest Plan, which has no Wilderness recommendation. Thus, 0 acres are recommended for Wilderness study under Alternative 1.

Alternatives 2 and 2M – As part of the Need for Change for plan revision, a new Roadless Area Inventory was conducted to determine the best pool of wilderness potential areas on the Forest. As noted above, 18 areas qualified for the inventory. Four of those areas are recommended for Wilderness study under Alternatives 2 and 2M, totaling an estimated 27,700 acres. This represents a potential 35 percent increase over existing Wilderness. Two of the areas, Dry Fork and Cranberry Expansion, would have the added effect of expanding contiguous Wilderness areas if they are designated by Congress. Roaring Plains West, though not contiguous with Dolly Sods Wilderness, would contribute to a block of MPs 5.0, 5.1, and 6.2 SPNM land of nearly 30,000 acres in that portion of the Forest.

Alternative 3 – Allocations are based on the theme of the alternative, which is maximum backcountry. Allocations include all areas in the latest IRA inventory that were considered to have good wilderness potential. The rest of the IRAs were given a 6.2 MP to help maintain their roadless attributes over time. The total of 99,400 acres recommended in 11 areas represents 11 percent of the Forest, and would more than double the amount of Wilderness that currently exists on the Forest should Congress designate all of the areas.

Alternative 4 – No areas are recommended for Wilderness under this alternative, which emphasizes vegetation restoration. Additional Wilderness was considered to be an impediment to achieving the vegetation restoration objectives of this alternative, due to constraints on road-building and timber harvest in a Recommended Wilderness MP, and the added difficulty of conducting prescribed burns without road-related access and fuel breaks.

Roadless Area Inventory and Wilderness Evaluation

A Roadless Area Inventory and Wilderness Evaluation were completed as part of the Forest Plan revision process (see Appendix C). Forty-one areas (326,539 acres) were initially identified and evaluated against the eight criteria for potential Wilderness in the East. Eighteen areas met all eight criteria and became the new Roadless Area Inventory. These 18 areas (143,234 acres) were evaluated based on their availability, capability and need for potential Wilderness. The 18 areas and their acreages are listed in Table RE-13.

Table RE-13. The Monongahela National Forest 2006 Inventoried Roadless Areas

Area	Acres	Area	Acres
Big Draft	5,395	Gauley Mountain West	6,624
Canaan Loop	7,850	Middle Mountain	12,197
Cheat Mountain	7,955	Roaring Plains North	3,119
Cranberry Expansion	12,165	Roaring Plains East	2,962
Dolly Sods North	7,215	Roaring Plains West	6,825
Dry Fork	739	Seneca Creek	24,974
East Fork Greenbrier	10,153	Spice Run	6,171
Gaudineer	6,727	Tea Creek Mountain	8,272
Gauley Mountain East	7,780	Turkey Mountain	6,111

Seven inventoried areas (Canaan Loop, Dolly Sods North, Gauley Mountain East, Gauley Mountain West, Roaring Plains East, Roaring Plains North, and Tea Creek Mountain) were not recommended for Wilderness under any alternative at this time due to: 1) their relatively lower values for wilderness attributes, and/or 2) their well-established pattern of non-conforming uses, and 3) the preferred alternative assigns them a 6.2 MP that would help maintain their roadless attributes over time. These values represent the relative development potential for managing the area based solely on its allocated MP. Specific information, and development potential for each area by alternative, are located in Appendix C – Roadless Area Inventory and Wilderness Evaluation. Appendix C also includes a general effects assessment of a Wilderness vs. a non-Wilderness designation, which is incorporated here by reference.

Table RE-14 displays the management disposition in the Roadless Area Inventory and Wilderness Evaluation, for each alternative in estimated acres. As the table numbers indicate, Alternatives 2, 2M, and 3 would have very low potential for developing any of the Inventoried Roadless Areas. Alternative 1 would have moderate potential for development, and Alternative 4 would have relatively high potential for development, as this alternative is designed to actively restore oak ecosystems, which comprise all or parts of a number of the roadless areas.

Table RE-14 . Management Disposition by Alternative for the 2006 Roadless Area Inventory Areas

Management Disposition	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Recommended Wilderness (MP 5.1)	0	27,700	27,700	99,400	0
Very low potential for development (MP 6.2, 8.1, 8.2, 8.3, 8.4, 8.5 Candidate Research Natural Areas)	104,500	115,600	115,600	43,900	63,100
Low to moderate potential for development (4.1, 6.3, 7.0)	12,700	0	0	0	48,400
Available for full range of development (2.0, 3.0, 4.0, 6.1, 8.6)	26,100	0	0	0	31,900

Note: Acres are rounded to the nearest 100 acres

Effects to the Forest Recreation Opportunity Spectrum (ROS)

Assigning 5.1, 6.2, and 8.1 SPNM MPs directly affects how much land is available for other MPs on the Forest, and indirectly affects how these lands would be managed over the planning period, and what other types of recreation opportunities may be available. The recreation settings and opportunities can be estimated to a relative degree by comparing the ROS class distribution that would be created by alternative.

See Table RE-6 in the Current Conditions section for summary descriptions of each ROS Class. The following assumptions were used to determine the desired condition percentages by ROS Class in Table RE-15. These assumptions were based on professional judgment, current and desired conditions, and the types of activities and ROS objectives emphasized by each MP. They have been refined from the broader assumptions presented in the DEIS.

- There are no Primitive ROS acres on the Forest due to existing and future road patterns.
- There are little or no Urban ROS acres of the Forest due to the general lack of urban-type development.
- There are some Rural ROS acres, but they are not associated with any particular MP, and any estimates by MP would be too small to register as a whole percentage.
- MPs 2.0, 3.0, and 4.0: 100% RN; primarily suited lands with a high degree of development.
- MP 4.1: 20% RN (suited lands), 40% SPM, 40% SPNM.
- MPs 5.0, 5.1, 6.2, and 8.1 SPNM: 100% SPNM.
- MP 6.1: 50% RN (suited lands), 25% SPM, 25% SPNM.
- MP 6.3: 33% RN, 33% SPM, 33% SPNM.
- MP 8.1 outside of SPNM: 70% SPM, 30% RN due to patches of development.
- MPs 8.2, 8.3, 8.4: 100% SPM; lands are largely undeveloped but are too small to be SPNM.
- MP 8.5 Fernow and Loop Road Research Areas: 50% RN, 50% SPM.
- MP 8.5 CRNAs: Pike Knob (1,950 ac.) is SPNM, the remaining areas (290 ac.) are SPM.
- MP 8.6: 100% SPM; areas features management but are not suited lands, many closed roads.

Table RE-15 provides a summary of existing and desired condition changes to the ROS by alternative, based on MP allocation.

Table RE-15. ROS Class Distribution by Alternative in Percent of Forest

ROS Class	Existing Condition	Alt. 1 Desired Condition	Alt. 2 Desired Condition	Alt. 2M Desired Condition	Alt. 3 Desired Condition	Alt. 4 Desired Condition
Primitive	0	0	0	0	0	0
Semi-Primitive Non-Motorized	21%	40%	40%	41%	54%	34%
Semi-Primitive Motorized	35%	19%	18%	18%	13%	21%
Roaded Natural	44%	41%	42%	41%	33%	45%
Rural	<1%	<1%	<1%	<1%	<1%	<1%
Urban	0	0	0	0	0	0

The existing condition percentages lean rather heavily toward the RN and SPM Classes due primarily to the legacy of roads, most of which were created during the extensive logging period of 70-120 years ago. The desired conditions recognize that many roads will continue to disappear or be decommissioned over time. Thus, all alternatives would have more potential SPNM Class in the future. The amount, however, differs by alternative, reaching a high point of 54 percent of the Forest in Alternative 3, and a low point of 34 percent in Alternative 4. Conversely, there is less SPM Class than present in all alternatives, ranging from 13 percent in Alternative 3 to 21 percent in Alternative 4. The RN Class is substantially associated with suited timberlands as well as roads, and it therefore varies in rough proportion to the suited lands by alternative.

In terms of recreational opportunities, SPNM would provide the potential for more challenging and non-motorized experiences in essentially undeveloped settings, whereas RN would provide the potential for both motorized and non-motorized experiences in a natural setting that would also have signs of development. SPM would restrict motorized opportunities but there may still be signs of development, such as recent timber harvest. Alternatives 1, 2, and 2M all show a relative balance between the RN and SPNM ROS Classes, with Alternative 2M showing a virtual one-to-one relationship. Alternative 3 would provide more backcountry recreation opportunities than any other alternative, while Alternative 4 would have the highest percentage of RN opportunities for those more interested in motorized recreation.

It is difficult to predict what effects the alternatives' ROS opportunities would have on recreation use or tourism. People recreate all over the Forest for many different reasons. Although an increase in backcountry recreation opportunities could attract those who prefer to camp and hike in undeveloped settings, it could also have a negative effect on those who enjoy motorized recreation or who want more motorized access for hunting or other activities. More discussion on visitor use related to backcountry recreation can be found in the Cumulative Effects section.

Effects to tourism are even more problematic to address, as potential influences on tourism patterns are complex and are not necessarily connected to Forest management activities or opportunities. For example, tourists may drive through the Forest on their way to nearby or distant destinations or events that have nothing to do with the Forest. We received comments on the DEIS to the effect that the visual effects from timber harvest would have a detrimental effect on tourism. However, in order to have any significant effect on the scenic backdrop of the Forest, very large amounts of harvest would have to occur in concentrated areas of visual sensitivity, and this scenario is highly unlikely to occur under any alternative due to management constraints in the 2006 Forest Plan and public involvement in Forest proposals under NEPA.

Cumulative Effects

Total Backcountry Recreation Opportunities

The total or cumulative backcountry recreation opportunities on the Forest are calculated by adding up the amount of land allocated to MPs 5.0 (Designated Wilderness), 5.1 (Recommended Wilderness), 6.2 (Backcountry Recreation), and the 8.1 areas that would be managed for a SPNM setting within the Spruce Knob-Seneca Rocks NRA. The totals for these areas are displayed in the Table RE-16, along with the percentage of NFS land they represent.

Table RE-16. Total Backcountry Recreation Opportunity Acres by Alternative

Recreation Opportunity Area	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Designated Wilderness (5.0)	78,700	78,700	78,700	78,700	78,700
Recommended Wilderness (5.1)	0	27,700	27,700	99,400	0
Backcountry Recreation (6.2)	124,500	97,500	106,800	225,900	51,000
SPNM Acres within NRA (8.1)	0	24,900	24,900	13,000	24,900
Total Acres	**203,200**	**228,800**	**238,100**	**417,000**	**154,600**
Percent of Forest	**22%**	**25%**	**26%**	**45%**	**17%**

Results range from 17 percent of the Forest under Alternative 4, to 45 percent of the Forest under Alternative 3. Alternatives 2 and 2M represent modest increases (25,600 acres and 34,900 acres, respectively) over the current opportunities portrayed by Alternative 1. Dispersed recreation enthusiasts would find more than twice the backcountry lands in Alternative 3 than are available under Alternative 1. People who favor road-related recreation would find the most opportunities available under Alternative 4.

As noted previously, there are additional backcountry recreation opportunities in the State of West Virginia provided primarily by State parks and Forests, and NFS land on the GW-Jefferson National Forests. Tables RE-17 through RE-21 compare the cumulative acres of national forest and state backcountry recreation opportunities, and the Monongahela contribution to those opportunities by alternative. For this exercise, backcountry recreation opportunities were considered SPNM areas such as MP 5.0, 5.1, 6.2, or 8.1 SPNM allocations.

Table RE-17. Backcountry Recreation Potential in West Virginia for Alternative 1

Indicator	Total Acres Public Land	Backcountry Acres (Desired Condition)	Percent of Total Backcountry Acres
Municipal/ County Backcountry	22,050	0	0%
West Virginia State Park/Forest Backcountry	416,863	0	0%
GW-Jefferson NF Wilderness Backcountry	123,629	12,400	6%
National Park Service Backcountry	66,159	0	0%
Army Corps of Engineers Backcountry	168,109	0	0
Monongahela NF 5.0, 5.1, 6.2, 8.1 Areas – Alternative 1	916,700	203,200	94%
Total Acres	1,713,510	215,600	100%
Percent of Total WV Public Lands with Backcountry Recreation Settings			12.6%

Table RE-18. Backcountry Recreation Potential in West Virginia for Alternative 2

Indicator	Total Acres Public Land	Backcountry Acres (Desired Condition)	Percent of Total Backcountry Acres
Municipal/ County Backcountry	22,050	0	0%
West Virginia State Park/Forest Backcountry	416,863	0	0%
GW-Jefferson NF Wilderness Backcountry	123,629	12,400	5%
National Park Service Backcountry	66,159	0	0%
Army Corps of Engineers Backcountry	168,109	0	0
Monongahela NF 5.0, 5.1, 6.2, 8.1 Areas – Alternative 2	916,700	228,800	95%
Total Acres	1,713,510	241,200	100%
Percent of Total WV Public Lands with Backcountry Recreation Settings			14.1%

Table RE-19. Backcountry Recreation Potential in West Virginia for Alternative 2M

Indicator	Total Acres Public Land	Backcountry Acres (Desired Condition)	Percent of Total Backcountry Acres
Municipal/ County Backcountry	22,050	0	0%
West Virginia State Park/Forest Backcountry	416,863	0	0%
GW-Jefferson NF Wilderness Backcountry	123,629	12,400	5%
National Park Service Backcountry	66,159	0	0%
Army Corps of Engineers Backcountry	168,109	0	0
Monongahela NF 5.0, 5.1, 6.2, 8.1 Areas – Alternative 2	916,700	238,100	95%
Total Acres	1,713,510	250,600	100%
Percent of Total WV Public Lands with Backcountry Recreation Settings			14.6%

Table RE-20. Backcountry Recreation Potential in West Virginia for Alternative 3

Indicator	Total Acres Public Land	Backcountry Acres (Desired Condition)	Percent of Total Backcountry Acres
Municipal/ County Backcountry	22,050	0	0%
West Virginia State Park/Forest Backcountry	416,863	0	0%
GW-Jefferson NF Wilderness Backcountry	123,629	12,400	3%
National Park Service Backcountry	66,159	0	0%
Army Corps of Engineers Backcountry	168,109	0	0
Monongahela NF 5.0, 5.1, 6.2, 8.1 Areas – Alternative 3	916,700	417,000	97%
Total Acres	1,713,510	429,400	100%
Percent of Total WV Public Lands with Backcountry Recreation Settings			25.1%

Table RE-21. Backcountry Recreation Potential in West Virginia for Alternative 4

Indicator	Total Acres Public Land	Backcountry Acres (Desired Condition)	Percent of Total Backcountry Acres
Municipal/County Backcountry	22,050	0	0%
West Virginia State Park/Forest Backcountry	416,863	0	0%
GW-Jefferson NF Wilderness Backcountry	123,629	12,400	7%
National Park Service Backcountry	66,159	0	0%
Army Corps of Engineers Backcountry	168,109	0	0
Monongahela NF 5.0, 5.1, 6.2, 8.1 Areas – Alternative 4	916,700	154,600	93%
Total Acres	1,713,510	167,000	100%
Percent of Total WV Public Lands with Backcountry Recreation Settings			9.7%

Based on the tables above, the alternatives would contribute anywhere from 93 percent (Alternative 4) to 97 percent (Alternative 3) of the backcountry recreation settings on public lands in West Virginia. As there are no comparable opportunities on private lands within the State, these figures apply equally to the entire State land base. Under any of the alternatives considered, therefore, the Monongahela would continue to be the primary provider of backcountry recreation settings and opportunities in the State of West Virginia.

The total acres contributed by each alternative would result in a much wider percentage range of backcountry recreation areas available in West Virginia. Alternative 1, which represents the 1986 Forest Plan as amended, would contribute to backcountry areas comprising an estimated 12.6 percent of all the public lands in the State. Alternatives 2 and 2M would raise the percentages to 14.1 and 14.6 respectively, Alternative 3 would effectively double the percentage to 25.1, and Alternative 4 would lower the current percentage to 9.7. People seeking backcountry recreation opportunities in West Virginia would have the most SPNM settings available by far in Alternative 3. Backcountry opportunities in Alternatives 2 and 2M would be substantially more than what they are currently (Alternative 1). Alternative 4 would lower the current backcountry recreation settings in the State by a substantial amount, which would likely be perceived as a step backward by Wilderness and other backcountry recreation enthusiasts, and a step in the right direction by those who feel the Forest and State already have more than enough backcountry recreation opportunities.

ROS and Visitor Use

The MNF Niche Statement describes the Forest as "the largest expanse of public land in West Virginia" and states that "the Forest provides the best opportunities for challenging and remote dispersed recreation in the State." The desired condition for Recreation Resources on the Forest is to offer "a wide spectrum of recreation opportunities," which includes settings ranging from SPNM to Rural.

National Visitor Use Monitoring (NVUM) was conducted on the MNF in 2003. The results indicate that about 16 percent (207,000 site visits) of the 1,303,000 annual site visits to the Forest are for activities primarily associated with backcountry recreation. These activities include 100 percent of primitive camping, backpacking and other non-motorized activities, and an estimated percentage of other activities that can occur either within or outside of backcountry areas. These estimated percentages include 50 percent of nature study and wildlife viewing, 25 percent of fishing, 20 percent of hunting, and 58 percent of hiking, walking, mountain biking and equestrian use. These percentages may be generous, as backcountry recreation areas comprise about 22 percent of the Forest, and opportunities for these types of activities exist throughout the Forest.

Wilderness use accounted for about 38,600 visits or 3 percent of the total Forest recreation use, and about 19 percent of the 207,000 backcountry site visits. Responding to the 2003 NVUM questions about crowding in Wilderness, visitors on the average felt that there were few people there. Nobody said the Wilderness they visited was overcrowded and 17.4 percent said there was hardly anyone there. User mean perception of General Forest Areas indicated that visitors who use the current backcountry areas felt that the areas were not overcrowded, and about 28 percent said that hardly anyone was there. Based on these findings, it appears that the Forest's existing Wilderness and backcountry recreation opportunities are meeting the current supply and demand of our visitors.

Projections for outdoor recreation participation by activity through 2050 show that activities associated with backcountry are expected to increase at a rate of 0.5 percent to 1.5 percent per year. These projections also indicate that many activities associated with non-backcountry recreation opportunities—such as developed camping, sightseeing, picnicking, visitor centers, etc.—along with activities that can occur in all ROS settings, are expected to increase at about this same overall average rate (Cordell 1999).

All acres of backcountry areas are not used the same. Some are more popular than others, many are seasonal, and most use is concentrated on trails and adjacent use areas. Because recreation use is not spread equally over backcountry areas and acres, specific areas such as Dolly Sods, Cranberry or Otter Creek are likely to see larger increases in visitation than areas like Middle Mountain, Spice Run, and other lesser-known areas. More popular areas may experience more crowding, but lesser known areas can supply opportunities for individuals seeking more solitude and semi-primitive recreation. These trends are likely to occur in non-backcountry areas as well.

The 1986 Forest Plan's current existing ROS classes are based on a 2003 ROS mapping exercise. The Forest currently provides for about 188,000 acres in a SPNM setting, about 318,000 acres in SPM and 401,000 acres in a RN setting. Based on the above NVUM information, this make-up of various ROS settings is meeting existing demand for recreational use.

Table RE-22. Projected Visitors Per 1,000 Acres of Backcountry Over Time

Alternative	Acres of Backcountry (MA 5.0, 5.1, 6.2, and 8.1 managed as SPNM	2003 Backcountry Visitors per Year per 1,000 Acres (estimated 207,000 site visits)	2013 Backcountry Visitors per Year per 1,000 Acres (estimated 229,000 site visits)	2023 Backcountry Visitors per Year per 1,000 Acres (estimated 253,000 site visits)	2033 Backcountry Visitors per Year per 1,000 Acres (estimated 279,000 site visits
1	203,200	1,019 (2.8 per day)	1,127 (3.1 per day)	1,245 (3.4 per day)	1,373 (3.8 per day)
2	228,800	905 2.5 per day	1,001 2.7 per day	1,105 3.0 per day	1,219 3.3 per day
2M	238,100	869 (2.4 per day)	962 (2.6 per day)	1,062 (2.9 per day)	1,172 (3.2 per day)
3	417,000	496 (1.4 per day)	549 (1.5 per day)	607 (1.7 per day)	669 (1.8 per day)
4	154,600	1,339 (3.7 per day)	1,481 (4.1 per day)	1,636 (4.5 per day)	1,805 (4.9 per day)

Table RE-22 compares annual visitors per 1,000 acres based on use projections over time by alternative. This assessment assumed an average annual increase of 1.0 percent. The acres are based on backcountry MP desired conditions for SPNM ROS settings. The range of use concentration varies considerably by alternative, with Alternative 3 having less than half the use predicted than Alternative 4. For those recreationists seeking a semi-primitive uncrowded experience, Alternative 3 would provide the best overall opportunities, followed in descending order by Alternatives 2, 1, and 4. However, even under Alternative 4, the maximum projected use—4.9 visitors per 1,000 acres a day by 2033—would be relatively uncrowded. Even at double the use, or with a 6-month season of use factored in, maximum visitation is projected at less than 10 people per 1000 acres a day, still relatively low. Based on visitor use projections, visitor responses to crowding, and land allocations in the alternatives, it is likely that overall backcountry supply will meet demand over the next two to three decades for all alternatives.

Scenic Environment

INTRODUCTION

The scenery visible to people visiting the Monongahela National Forest (MNF) constitutes the scenic environment. Scenery is described as the general appearance of a place or landscape, or the features of a landscape. The visual condition varies by location and is dependent on human developments and natural features such as geology, vegetation, and landforms.

The MNF provides some of the highest quality scenic landscapes in the East. Enjoyment of these scenic resources is an integral part of many recreation experiences, both on and near the MNF, and these scenic attractions have contributed to making a number of locations on the Forest nationally recognized recreation destinations. As an example, the Spruce Knob-Seneca Rocks National Recreation Area (NRA) was established in 1965 based on, among other things, the preservation of the high-quality scenic environment as a backdrop for recreational pursuits.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect the scenic environment.

Background

No major issues directly related to scenic resources were identified during scoping or the Need For Change analysis process. However, many comments received did indicate an interest in the Forest's scenery and how management activities may affect that scenery. Management activities have the potential for directly, indirectly, and cumulatively affecting scenic resources through vegetation management, restoration, or development activities. These activities are related to many of the Need For Change topics, and could be implemented under any of the alternatives. Disturbance events of insect infestations and wildfire events can also affect scenic resources.

Indicators

The following indicators reflect the potential relative change under each alternative based on anticipated levels of management activities that could have substantial effects on the scenic environment:
- Acres of even-aged harvest by alternative,
- Acres of intermediate treatment by alternative,
- Acres of prescribed fire use by alternative.

The potential for ecological disturbance events (insects, disease, wildfire) to affect the scenic environment will also be discussed.

Scope of the Analysis

The affected area for direct and indirect effects to the scenic environment is land administered by the Forest. This area represents the National Forest System (NFS) lands where the scenic environment exists, and the lands where those resources could receive impacts from both management activities and disturbance events. The affected area for cumulative effects includes the lands administered by the Forest, and lands of other ownership both within and adjacent to the Forest boundaries. Cumulative effects to resources on other land ownerships are addressed to lend a broader perspective to the importance of scenic resources on the Forest and to recognize the inter-relationships with those lands. Temporal effects are discussed in terms of temporary (1-12 months), short-term (1-5 years), and long-term (over 5 years) time frames.

CURRENT CONDITIONS

The present landscape is a result of the interactions of existing vegetation and landforms on line, form, color, and texture of the viewed scenery. Visual conditions vary by location and are dependent on such influences as geology, water, vegetation, landforms, and human developments and activities. The scenic landscape is a dynamic medium and is continuously modified by both human and natural forces. Much of the landscape that comprises the Forest has been altered by human developments and activities as well as recent disturbance events such as small-scale wildfires and insect infestations. Some of these altered landscapes are not obvious to casual viewers because they still present natural-appearing landscapes.

The Scenery Management System (SMS) is a management tool that determines scenic values and establishes allowable levels of human-caused change to the scenic environment. This system is used in the context of Forest management to inventory and analyze effects to scenery, assist in developing resource goals and objectives, monitor scenic integrity, and ensure that attractive landscapes are sustained for the future. More details regarding the System can be found in Agriculture Handbook Number 701, Landscape Aesthetics, A Handbook for Scenery Management and the Monongahela National Forest Scenery Management Analysis (2004).

Landscape Character

The Monongahela National Forest is mountainous. This has important implications on how the Forest is seen and how the people feel about living, recreating, and working within it. The public involvement that took place when the 1986 Forest Plan was being written made it clear that the entire Forest is a special place to West Virginia residents. Its presence is regarded as a contrast to the remainder of West Virginia where the impacts of extractive industries and urban developments are relatively more common. Threats to its well-being are taken seriously. Individuals and communities also identify with specific smaller locations within the Forest.

Being a mountainous Forest, the Monongahela puts management activities up as on an easel for all to see. When compared to a national forest with flatter topography, management activities are more visible and more difficult to screen from public view. As a general rule, residents and visitors travel in the open valleys and the Forest forms a backdrop on the mountains and ridges behind the houses and beside the roads. Also because it is a mountainous area, the Forest offers outstanding recreation opportunities ranging from the dispersed to the developed. Visitors penetrate the Forest on foot and in vehicles, potentially becoming close-up viewers of all that happens. Changes are seen.

In order to establish a baseline against which to measure and evaluate changes within the landscape, a description of the existing landscape character is needed. Landscape character is a reflection of the physical, biological, and cultural attributes in the landscape, and the beliefs, values and attitudes that people assign to these attributes. The existing landscape character has its origins in and is informed by early settlement patterns and land uses that have taken place over the years. These early and continuing influences affect the attitude toward landscape uses today. It is the physical appearance and cultural context of a landscape that gives it an identity and a "sense of place." The descriptions below create images of the landscape. The narratives include landform patterns, water characteristics, vegetative patterns, and cultural elements. The descriptions are based on an ecological framework developed by the Forest ecologist and others.

The Landscape Character descriptions are divided into the four ecological zones: Red Spruce, Northern Hardwood, Red Oak/Sugar Maple, and Mixed Oak. These four ecological zones are described briefly below. Full descriptions are available in the Monongahela National Forest, Scenery Management System Guide.

Red Spruce Zone

The existing landscape character of the red spruce zone is found in several areas across the Forest, generally on the high-altitude mountain tops and ridges and extending only a short distance down slope. Mountaintops are often relatively flat to gently rolling. In other locations, the red spruce zone is found on moderately dissected plateaus with steep slopes and narrow valleys. Elevations range from around 3800 feet to over 4000 feet. Soils are acidic. When seen from vantage points outside the zone, the red spruce usually appears as a dark, finely textured cap on an otherwise hardwood-clothed mountain. For visitors within the red spruce zone, views are usually of the enclosed foreground type but, because of the location on top of the mountains, this zone offers more than the average number of panoramic background views. Special places within the red spruce zone include Dolly Sods Wilderness and Scenic Area, Gaudineer Scenic Area, Otter Creek Wilderness, the Upper Shavers Fork River valley, Canaan Mountain, Cheat Mountain Fort (a civil war encampment site), and portions of the Cranberry Wilderness.

Northern Hardwood Zone

The northern hardwood zone consists of the dissected Appalachian Plateau at its juncture with the ridge and valley section. Landforms are rolling to steeply sloped mountains with narrow, winding valleys. Elevations range from 2800 to over 4000 feet. Visitors encounter mostly enclosed, foreground views; but a few distant panoramas do exist. Special places within the northern hardwood zone include portions of the Seneca Creek Backcountry, Bickle Knob, and Camp Pocahontas 4H Camp. Water is an important element visually and for recreation. Spruce Knob Lake, an impoundment, is a popular fishing site, as are Laurel Fork, Gandy Creek, and

Seneca Creek. Streams in the zone have steep gradients, are swift flowing, clear, and normally have horizontally fractured, dark brown rock beds.

Red Oak/Sugar Maple Zone

The red oak/sugar maple zone lies at lower elevations, down slope from the red spruce. It forms the even-textured, light green hardwood backdrop against and in contrast with which the dark spruce is seen. The landforms of the zone vary from gently rolling, highly dissected low hills to steep-sided, massive mountains. Valleys are narrow to very narrow and winding. Visitors encounter enclosed landscapes with foreground detail views. Views of the near middle-ground are common, but background vistas are rare. In the northern portion of the Forest, the red oak/sugar maple zone is generally found on the mid to lower slopes. In the south, the zone ranges from the valleys to the ridgelines in many areas. Mauch Chunk soils, found within the zone, are the most productive on the Forest, but are highly erosive. Special places within the red oak/sugar maple zone include the Falls of Hills Creek, Whitaker Falls, Summit Lake, portions of the Cranberry Wilderness and Backcountry, Cranberry Glades, and Highland Scenic Highway.

Mixed Oak Zone

The mixed oak zone lies in three large portions of the Forest. In the ridge and valley section, narrow valleys divide the long northeast-southwest trending ridges. In the Tygart River Valley the landform includes terraces and foothills. Riparian valleys are found along the Tygart and Potomac Rivers. Visitors find that views are not as enclosed as in the other zones, but panoramic, background views are rare. The lowest elevations on the Forest are found within this zone. Many special places are found within the mixed oak zone. The Seneca Rocks portion of the Spruce Knob-Seneca Rocks NRA is a particularly important area. The Smokehole Valley, Hopeville Gorge, and much of the Greenbrier River Trail are found within the mixed oak zone.

Landscape Visibility

Landscape visibility is the accessibility of the landscape to viewers, referring to one's ability to see and perceive landscapes. It is a function of many essential interconnected considerations including; context of viewers, duration of view, degree of discernible detail, seasonal variations, and the number of viewers. Landscape visibility consists of three elements; travel and use areas, Concern Levels, and Distance Zones. The existing landscape visibility for the MNF was mapped in 2004 and is based on topography, not vegetation. Distance Zones were produced in Arc View by using an offset algorithm. Once the maps were produced, actual seen areas were substituted for a few key areas where Forest employees determined major areas could not be actually seen. The landscape visibilities are:

> **Foreground –** Within 0 feet and ½ mile. The foreground is a detailed landscape where people can distinguish small boughs of leaf clusters, tree trunks, large branches, individual bushes, and medium size animals.

Middleground – Within ½ to 4 miles. This is usually the predominant distance zone at which Forest landscapes are seen. At this distance people can distinguish individual tree forms, large boulders, flower fields and small openings.

Background – From 4 miles to horizon. At this distance people can distinguish groves or stands of trees and large openings in the Forest.

Seldom Seen – These landscapes are not visible in the foreground, middleground, or background from any selected viewpoint, travel way, or use area.

The following table shows the existing Landscape Visibility on the Forest.

Table SE-1. Landscape Visibility on the Monongahela National Forest

Landscape Visibility	Estimated Acres and % of National Forest System Lands	Estimated Acres and % of All Other Ownership Lands Within the Proclamation Boundary	Estimated Total Acres and % Within the Proclamation Boundary
Foreground (Fg)	380,000 - 42%	120,000 - 14%	500,000 - 29%
Middleground (Mg)	420,000 - 46%	370,000 - 45%	790,000 - 45%
Background (Bg)	30,000 - 03%	130,000 - 15%	160,000 - 9%
Seldom Seen (Ss) Areas	85,000 - 09%	220,000 - 26%	305,000 - 17%
Total	915,000 - 100%	840,000 - 100%	1,755,000 - 100%

Note: Acres have been rounded to the nearest 5,000

Scenic Attractiveness

Scenic Attractiveness is the importance of the landscape based on human perceptions of the intrinsic beauty of landform, rock form, water form, and vegetative pattern. There are three categories of Scenic Attractiveness:

A – Distinctive: Refers to extraordinary or special landscapes. These landscapes are attractive, and they stand out from common landscapes.

B – Typical: Refers to prevalent, usual, or widespread landscapes within a landscape province. It also refers to landscapes with ordinary or routine scenic attractiveness.

C – Indistinctive: Landscapes with no scenic attractiveness.

The Scenic Attractiveness layer for the Forest was developed using Wilderness, buffered lakes and rivers, Inventoried Roadless Areas, Scenic and Special Areas and remote backcountry for Distinctive (A). The remaining NFS lands were mapped a Typical (B) because no Indistinctive (C) lands were identified. The following table identifies Forest acres by Scenic Attractiveness.

Table SE-2. Scenic Attractiveness on the Monongahela National Forest

Scenic Attractiveness	Estimated Acres and % of National Forest System Lands	Estimated Acres and % of All Other Ownership Lands Within the Proclamation Boundary	Estimated Total Acres and % Within the Proclamation Boundary
A = Distinctive	245,000/ 27%	155,000/ 18%	400,000/ 23%
B = Typical	670,000/ 73%	685,000/ 82%	1,355,000/ 77%
C= Indistinctive	0	0	0
Total	915,000/ 100%	840,000/ 100%	1,755,000/ 100%

Note: Acres have been rounded to the nearest 5,000

Scenic Classes

Scenic Classes are classifications that prioritize land based on their importance and scenic value. Scenic Classes were inventoried and mapped for the Forest by considering 1) the scenic attractiveness of the land and 2) visibility from travel ways, use areas and water bodies with different levels of concern by the public. Concern Levels describe the relative importance of scenery to the public. Sometimes it is impossible to separate emotional attachments to a landscape from the perceived beauty, so the Forest used several determining factors to assign Concern Levels to roads, trails, developed recreation sites, many lakes and streams, designated areas such as Wilderness or the NRA, and other use areas.

The components of Scenic Class are Scenic Attractiveness and Landscape Visibility as described above. Agriculture Handbook Number 701, Landscape Aesthetics, A Handbook for Scenery Management, provided the primary direction for the scenic inventory. Table SE-3 summarizes the inventory process. This coverage was created by manuscripting areas and scanning them from old Variety Class maps and then editing them as necessary using digital orthoquads as background. Additional information regarding this process can be found in the Monongahela National Forest, Scenery Management Analysis, December 2004.

Table SE-3. Scenic Class Matrix

Scenic Attractiveness Concern Levels	Distance Zones											
	Fg1	Mg1	Bg1	Fg2	Mg2	Bg2	Fg3	Mg3	Bg3	Ss1	Ss2	Ss3
A - Distinctive	1	1	1	2	2	2	2	3	3	1	2	3
B - Typical	1	2	2	2	3	4	3	5	5	2	3	5
C - Indistinctive	1	2	3	2	4	5	5	6	7	3	5	7

*Scenic Integrity Classes = (1) Very High, (2) High), (3) Moderate to High, (4) Moderate, (5) Moderate to Low, (6) Low, (7) Very Low

Specific information regarding this table can be found in the Scenery Management System, Agriculture Handbook Number 701, Chapter 4, pages 15-16.

Scenic Integrity

Scenic Integrity is an indication of the state of naturalness or, conversely, the state of disturbance created by human activities or alteration. More importantly, it measures how closely the landscape approaches the character desired over the long term. It is stated in degrees of deviation from this desired character. Landscape character with a high degree of Scenic Integrity has a sense of wholeness or being complete. In the SMS process, Scenic Integrity is managed in degrees ranging over seven levels from Very High to Very Low. Scenic Integrity Levels are:

Very High – Landscape is unaltered
High – Landscape appears unaltered
Moderate to High – Landscape appears slightly altered
Moderate – Landscape appears moderately altered
Low to Moderate – Landscape appears moderately to heavily altered
Low – Landscape appears heavily altered
Very Low – Landscape is heavily altered

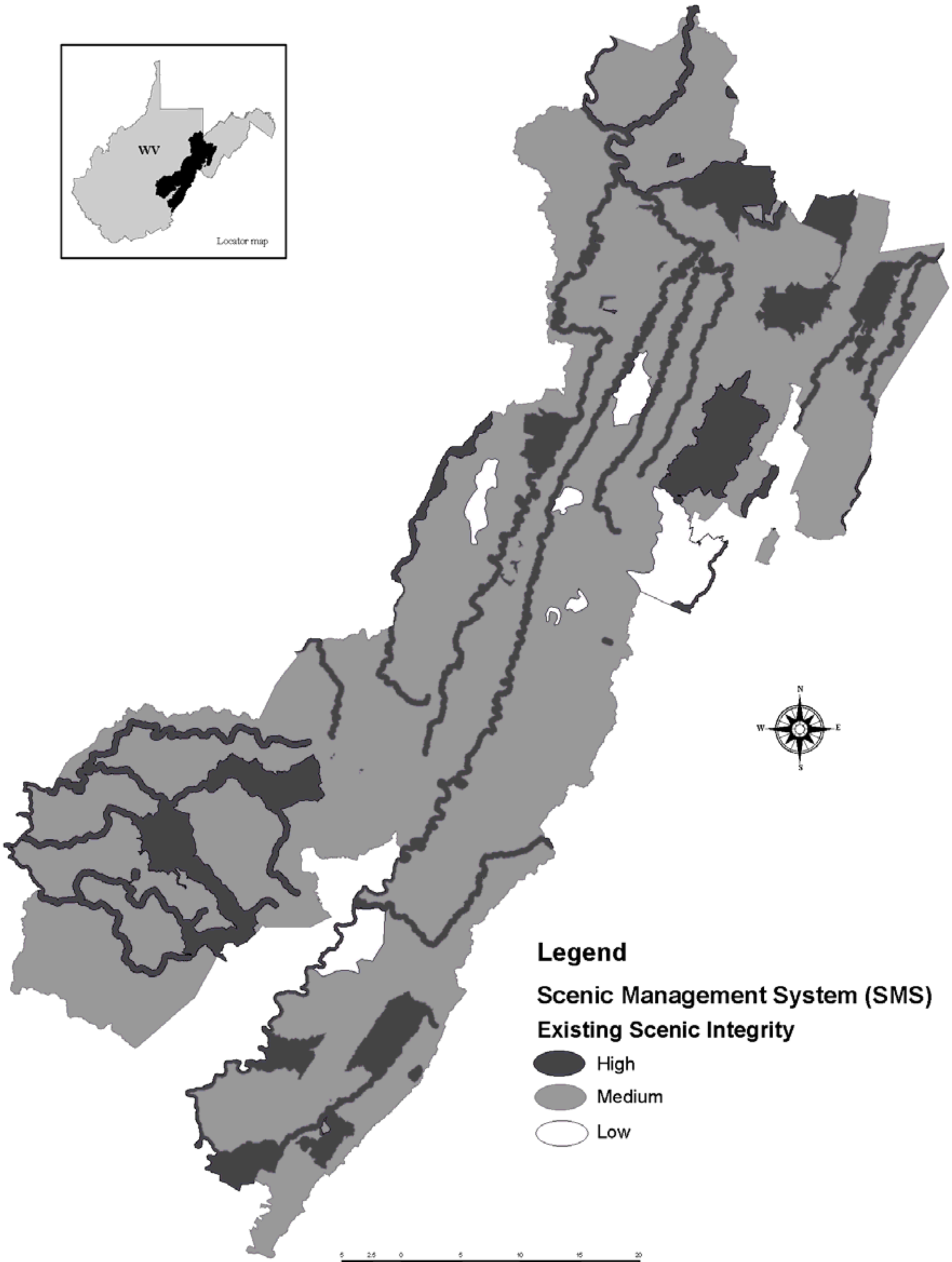
Scenic Integrity Objectives

Scenic Integrity Objectives (SIOs) are measurable accomplishments noting changes to the visual landscape over time. The adopted objectives are an expression of the likelihood for deviations from the desired landscape character. It is important to note that interim or short-term integrity levels may be necessary to reach a long-term character goal. Once that goal is achieved, the integrity may actually be higher than present. Once achieved, on-going management should maintain the ability to perpetuate the vegetation within the parameters of the assigned SIO. The assigned SIO describes the appearance of the desired landscape condition. Using an example of regeneration harvest, a SIO of High describes the appearance of the long-term outcome of the harvest, not the original timbered condition or the immediate operation of timber harvesting. Figure SE-1 maps the existing scenic integrity of the Forest into the three categories seen in Table SE-4.

Table SE-4. Acres and Percent of Existing Scenic Integrity for the Forest

Existing Scenic Integrity	Estimated Acres and % of National Forest System Lands	Estimated Acres and % of All Other Ownership Lands Within the Proclamation Boundary	Estimated Total Acres and % Within the Proclamation Boundary
Very High, High	240,000 - 26%	140,000 - 17%	380,000 - 22%
Moderate to High, Moderate, Low to Moderate	630,000 - 69%	670,000 - 80%	1,300,000 - 74%
Low, Very low	45,000 - 5%	30,000 - 3%	75,000 - 4%
Totals	915,000 - 100%	840,000 - 100%	1,755,000 - 100%

Figure SE-1. Existing Scenic Integrity on the Monongahela National Forest



ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Management area goals and prescriptions have been considered together with existing scenic resources and values to produce scenic environment direction and SIOs. In most cases, the original inventoried Visual Quality Objectives have been adopted as the management direction. Some have been modified to compliment unique circumstances, such as Recommended Wilderness. Forest Plan direction will direct rehabilitation, enhancement of visual quality, integration of aesthetics in resource planning, and efforts to vary stand densities to create vegetation diversity. As such, the SIOs are used in project design to protect important scenic values, while allowing an acceptable level of landscape change where appropriate. The SIOs are established for all areas within the Forest, reflecting sensitive areas of high visual concern as well as areas of low scenic priority. Project proposals are designed or modified to meet the established SIOs. Examples of mitigation efforts commonly used to help meet the SIOs include revegetating disturbed sites, choosing materials and colors for structures that reduce their visibility, placing utility lines underground, designing timber harvest units to blend with the natural-appearing landscape, and using locations that provide vegetation screening.

Effects Common to All Alternatives

General Effects

Scenery is an integral component of all national forest settings, and contributes to the quality of the visitor's experience. It has also been altered in numerous locations across the Forest by both human and natural forces. Obvious effects on visual resources arise from a variety of resource management activities and public uses such as logging, mining, and utility corridors that alter vegetation and landscape appearances. The relative amount of these activities and uses may, in some cases, vary by alternative. However, they are likely to be present to some extent in all alternatives.

Visual effects of management activities and disturbance events are seldom limited to the specific location of the activity or the event. As seen from a travel route or use area, such alterations can affect the visual appearance of the entire viewed landscape or "viewshed".

Activities that have the potential to affect the scenic environment may include timber harvest; road construction, reconstruction, and decommissioning; prescribed fire; facility relocation and modification; fish habitat improvement; streambank stabilization; slope stabilization; and mining reclamation. Their effects are described in greater detail below.

Timber Harvest - Effects can vary depending upon the quantity and type of timber removed, logging methods, and the setting. Generally, timber removal—and any associated roads, skid trails and slash treatments—results in adverse effects to the scenic environment arising from vegetation change or removal and ground disturbance. These impacts are usually the most dramatic in areas where no visible evidence of human development activities has previously occurred. Thinning and selection harvests usually have lower impacts and are also evident for a shorter duration than overstory removals, shelterwood harvests, and clearcuts. Helicopter logging does not create skid trails or yarding corridors that contribute to the visual impacts of ground-based and cable logging systems. Timber management may also be used to improve scenic quality, particularly where there are opportunities to enhance scenic views, to provide a landscape associated with the public's expectation, and to achieve timber stand characteristics that are more visually appealing.

Roads and Trails - Construction, reconstruction, and decommissioning can all affect the scenic environment. Road construction and reconstruction are usually associated with timber harvest, facility development, utility corridors, telecommunications sites, mineral and energy development, and recreation activities. Roads and trails create a long-term visual impression on the landscape from associated vegetation clearing and ground disturbance activities. These effects are usually magnified by the linear nature of the pattern of disturbance, especially in forested landscapes. The extent of the impact depends upon topography, service type, soils, geology, and the nature of surrounding vegetation. The visual impact from trails is usually somewhat less due to their smaller width, which reduces the level of ground disturbance and makes impacts easier to mitigate in most cases. Road and trail decommissioning includes a variety of management actions ranging from simple closures to complete obliteration. Obliteration can often eliminate the visual impacts of a road or trail over the long term as vegetation matures in former road or trail locations; however, temporary or short-term effects of ground disturbance are often greater than closures.

Mineral and Energy Exploration, Development, and Reclamation – Exploration and development activities can result in both short-term and long-term effects from associated structures, vegetation clearing, and ground-disturbing activities. The effects on scenic resources vary depending largely on the scale and location of development and mineral ownership. Small-scale developments of a few acres, or underground mining, would have very limited impacts, while large-scale surface mining operations typically have major effects on the scenic quality of the surrounding area. Mining reclamation activities can also result in temporary or short-term effects to the scenic environment, but these effects are generally no worse than the conditions being reclaimed, and reclamation results in long-term improvement to the visual landscape. In that the level of mineral exploration and development is largely driven by market forces and regulated by existing mining law, there would be little difference between the alternatives in effects on the scenic environment. Reclamation activities may vary depending on differences in alternative restoration emphasis.

Facilities and Structures – These include a broad array of physical developments and structures, such as administrative facilities, dams and diversions authorized under special use authorizations, and mining facilities. Usually, there are both short-term and long-term visual effects from structures, vegetation clearing, and ground disturbance activities. These effects vary depending on the scale and nature of the development, as well as the setting. Road construction for installation and/or maintenance purposes can contribute to the impacts of the facility.

Utility Developments – These developments include pipelines and overhead power-line clearings that can result in both short-term and long-term effects from associated permanent structures, reflective materials, vegetation clearing, and ground-disturbance activities. These effects are usually magnified by the linear nature of the pattern of disturbance, especially in forested landscapes. Road construction for installation and/or maintenance purposes often contributes to the impacts of the utility line. Site-specific analysis would be required prior to approval or implementation of any utility corridor development.

Telecommunications Sites - Communications developments can result in both short-term and long-term effects from associated permanent structures, vegetation clearing, and ground disturbance activities. These effects are usually localized at individual sites that cover a few acres or less in size. However, communication sites often must be located on highly visible peaks or along well-traveled corridors that make mitigation of visual impacts difficult if not impossible. Road construction for installation and/or maintenance purposes can contribute to the impacts of the telecommunication site. Site-specific analysis would be required prior to approval or implementation of any telecommunication site development.

Recreation - Activity impacts to the scenic environment depend on recreation uses and levels, and soil and vegetation types. Off-road and off-trail travel and dispersed camping can cause erosion, ground disturbance, or loss of vegetation. Although all forms of travel have potential to cause these types of impacts, effects associated with most forms of motorized travel are usually the most pronounced due to the combination of vehicle weights, widths, and their creation of continuous track lines. Off-road and off-trail traffic is currently prohibited on the Forest.

In addition to the visible effects of activities, recreation developments can contribute to the loss of natural-appearing landscape character by introducing numerous vehicles, groups of buildings, and conspicuous structures. As with other structures and facilities, the effects range from short to long term in duration and can vary depending on the scale and nature of the development, as well as the setting.

Scenic Byways – One State Back-way and one federally designated Scenic Highway cross NFS lands. This designation is an indicator that scenic resources along these routes are especially attractive and important to the public. SIOs for these corridors will reflect the heightened importance and provide sufficient protection to maintain their high scenic values.

Spruce Knob-Seneca Rocks National Recreation Area – The law that established the NRA emphasized 1) public outdoor recreation benefits; 2) conservation of scenic, scientific, historic, and other values contributing to public enjoyment; and 3) such management, utilization, and disposal of natural resources which will promote and does not significantly impair the purposes for which the recreation area was established.

Range Management - Livestock grazing and range improvements may result in an altered landscape appearance. Changes to the landscape appearance may include differences in the type and amount of vegetation on the land, vegetation trampling, and range improvement structures. Effects from grazing depend largely on the intensity and timing of forage utilization. Normally, allotment management plans require permittees to move their livestock so that they do not concentrate in sensitive areas, like meadows and riparian areas. Although there could be effects from seasonal trampling and heavy utilization of the forage, the potential for change to the scenic environment is relatively slight, especially as livestock grazing only occurs on less than one percent of the Forest. Structural improvements, such as fences, may be visually evident and can detract from the natural-appearing landscape. Mitigation may include relocating or redesigning fences where possible, or removing them where they are no longer needed. Generally, improvements are small and localized, and have a minor effect on the scenic quality of the surrounding area.

Watershed Improvements - A broad array of physical alterations may include streambank and channel stabilization structures (rock gabions, rock riprap, etc.), road reconstruction (culvert replacements, road re-alignment, etc.), slope stabilization structures, and revegetation. Some structural improvements can be visually evident and detract from the natural-appearing landscape character. Duration of effects from these types of structures ranges from short term to long term and also depends on the scale of the structures themselves. Generally, most improvements are small and localized, and have a minor effect on the scenic quality of the surrounding area.

Fish and Wildlife Habitat Improvements - A broad array of physical alterations may include vegetation manipulations (maintained wildlife openings, browse species plantings, etc.), prescribed burning, and habitat improvement structures. Some structural improvements may be visually evident and can detract from the visual landscape, but are infrequently used. Others may be designed to improve the scenic environment over time. Negative impacts may be mitigated through design and location considerations, and vegetative cover plantings where possible. Generally, improvements are small and localized, and have a minor effect on the scenic quality of the surrounding area.

Disturbance Events – Scenic resources comprise a dynamic environment. Changes to scenery will occur with or without human activity. Wildland fire, insects, disease, landslides, and other disturbances can greatly affect scenic resources, especially when the scale of the events is large.

Insect and disease outbreaks can result in large areas of dead trees. Stands of predominantly dead trees can then become fire hazards, for a period of time, indirectly increasing the potential for wildfire effects to scenic resources. In some cases, salvage logging is used to capture economic value in large areas of tree mortality, but additional or different visual long-term impacts may occur from new roads and salvage harvest units.

The visual effects from wildfire depend upon the severity, intensity, and magnitude or scale of the fire. A low to moderate intensity fire of mixed severity can result in a vegetation mosaic across the landscape producing a long-term positive visual benefit by increasing the diversity of vegetative species, structure, size and age classes, snags, and coarse woody debris. On the other hand, large-scale burning, ground scorching, and tree and shrub mortality can alter the scenic values associated within an area and reduce the inherent visual complexity and scenic values of a landscape. The large-scale loss of vegetation can have short-term negative impacts from burned landscapes, as well as long-term impacts in the form of a more simplified landscape mosaic. Additionally, many people find burned landscapes visually unappealing and unattractive. Fires that burn with uniformly high intensity and severity across large areas have the greatest impacts on visual resources and are long term in duration. Wildland fire usually also results in temporary visibility impairment from smoke. Smoke from fires can partially or completely obscure the high-value scenic attractions that characterize much of the Forest. It is difficult to predict how or where or when these changes might occur due to influential variables such as vegetation patterns, disturbance regimes, climate, and topography.

Wildfire Suppression – Fire suppression activities produce effects to the scenic environment both directly and indirectly. Some firefighting activities, such as mechanical fire line and safety zone construction, can result in direct, long-term effects from vegetation clearing and ground disturbance. In the case of fire line construction, these effects are usually magnified by the linear nature of the pattern of disturbance. In some vegetation types, fire suppression can and has produced vegetative conditions that would not be present had fire occurred at historical levels. To some extent, this has resulted in landscapes with less visual diversity than what would be present in the absence of fire suppression.

Prescribed Fire – Prescribed fire can result in temporary visibility impairment from smoke. Smoke from fires can partially or completely obscure the high value scenic attractions that characterize much of the Forest. Prescribed fires usually also result in both short-term and long-term visual effects in the form of landscapes having burned appearances. In many cases, fires are designed to mimic historical fires in post-fire appearance over time. However, many people find the post-fire appearance of burned vegetation to be unattractive. Prescribed fire is generally used in areas comprised of vegetation characterized by non-lethal or mixed1 fire regimes to reduce ladder fuels and restore or maintain desired vegetative conditions. In these circumstances, fire intensity, severity, and scale are generally lower and smaller, and result in less visual impacts of shorter duration than wildland fire events. In some cases, fire may be used to improve scenic quality. For instance, fire can be used to reduce slash or to achieve timber stand characteristics that are more visually appealing, such as open stands of large trees.

Direct and Indirect Effects by Alternative

Under any alternative, proposed projects that may affect scenery would be accompanied by a site-specific assessment of their potential impacts on the scenic environment. The Scenery Management System, which is used to develop SIOs, is based on the concept that a natural-appearing landscape character is preferred. As such, SIOs provide a means of measuring the greatest acceptable deviation from a natural appearance. The SIOs are used to design management activities so that projects do not exceed the recommended threshold of change to the scenic environment.

In general, SIOs are established from consideration of the combination of scenic values, human sensitivities, and the needs for management of other resources. All of these factors vary by location across the Forest, which results in varied levels of each SIO class. SIOs can constrain management activities to protect scenic resources. In some cases, management decisions are made that constrain activities to levels below those allowed by established SIOs to protect other resource values. This is a benefit to scenic resources in that it is always desirable from a scenic environment perspective to retain more of the natural-appearing landscape character.

Individual projects are tailored to fit the SIOs established in the Forest Plan. Once established, the SIOs become a fixed obligation or criteria for project level performance and must be constraining enough to limit changes to the visual landscape to an acceptable level. At the same time, SIOs must also be consistent with the attainment of the established multi-resource goals and objectives stated in the Forest Plan.

Activities Affecting The Scenic Environment

Some of the alternatives present considerable differences in the amounts and types of activities that would occur across the landscape. Some activities would have relatively minor potential to cause noticeable change in the landscape, while others have the potential to cause very noticeable changes. The actual social impact of such changes in the landscape will vary according to the visibility of activities, the surrounding landscape setting, and the visual sensitivity of the travel route or use area from which the activities might be viewed. The assignment of SIOs helps to control the magnitude and intensity of such changes across the landscape in some areas and all alternatives have the same SIOs. While in other areas, other factors, such as the presence of listed species or high levels of water quality concern, may play an even greater role in controlling the magnitude and intensity of changes to the landscape.

While the specific effect of an individual activity is dependent on many site-specific variables, the overall amount of various activities can be used as a gross indicator of the overall changes that could occur across the landscape and how they would vary by alternative. For this analysis, it is assumed that alternatives with greater amounts of vegetation treatments would, as a general rule, result in landscape settings that appear more manipulated or altered to the casual viewer.

Groupings of similar activities for tracking such potential changes by alternative were made in order to simplify and capture those activities that have the most potential for affecting change on the landscape. Three different activity groupings were made:

Even-Aged Regeneration Harvest - This activity grouping consists of clearcut with reserve trees, seed tree regeneration, and shelterwood harvests. These activities have the greatest potential of all vegetation treatments to create very noticeable short- and long-term changes in the forested landscape from the removal of substantial portions of the forested canopy.

> *Intermediate Vegetation Treatments* - This grouping consists of commercial thinning, selection harvest, and pre-commercial thinning. While there is a wide range of potential effects due to the variability in the intensity of tree removal, generally the change is subtle and does not dominate the landscape. Temporary visual effects generally would occur from ground disturbance and logging residue from harvest operations. Short-term and long-term visual effects would occur from the reduction in forested cover density and a more open forested appearance. Treatments would typically result in more open stands characterized by large trees with reduced understories. These treatments are likely to have much lower visual impacts than even-aged regeneration harvests, and may be perceived by many as an enhancement to the scenic environment over the long term.

Prescribed Fire - This activity consists of using prescribed fire for achieving management goals. Visual impacts can vary considerably with the magnitude and intensity of the fire. The effects are often dominant on the landscape immediately following the activity and for a few following years. With accelerated regrowth of herbaceous and understory vegetation, the major visual effects are usually temporary or short term. Often these effects may be perceived as resulting from the natural occurrence of fire in the landscape. Long-term visual effects are subtler, resulting in more open stand conditions, again depending on the intensity of the fire. As noted above under *General Effects*, fire intensity, severity, and scale are generally lower and smaller in prescribed fire than in wildland fire. As a result, prescribed fires usually produce visual impacts of shorter duration and reduced severity than large wildfire events. Prescribed fire typically occurs under prescribed conditions that would limit intensity, duration, and severity to acceptable levels.

Alternative Comparison – Timber harvest numbers in Table SE-3 are estimates from SPECTRUM modeling of levels of activities that could occur given certain management constraints (see Appendix B for modeling assumptions and application). These numbers can be used for the relative comparison of alternatives, but are not intended to represent actual acres or miles of projected activities. Table SE-5 compares activities by alternative that could affect visual quality on the Forest over the next two decades, using annual averages from the model. It should be noted that SIOs are designed to mitigate any long-term effects to the landscape's scenic integrity.

Table SE-5. Maximum Potential Activities That May Affect Scenic Integrity by Alternative
(Estimated annual average of acres for the first two decades, based on Spectrum outputs)

Activity Group	Maximum Annual Activity Acres				
	Alt. 1	**Alt. 2**	**Alt. 2M**	**Alt. 3**	**Alt. 4**
Acres of Regeneration Harvest	3,450	3,650	3,600	2,670	4,450
Acres of Intermediate Thinning	2,120	870	860	1,610	740
Acres of Prescribed Fire	300	3,000	3,000	300	7,500
Totals	**5,870**	**7,520**	**7,460**	**4,580**	**12,690**

Alternative 3 would have the least amount of even-aged regeneration harvest over the next two decades, followed in ascending order by Alternatives 1, 2M, 2, and 4. Alternative 4 would have the least amount of intermediate treatments, followed in ascending order by Alternatives 2M, 2, 3, and 1. Alternatives 1 and 3 would have the least amount of fire use acres, followed by Alternatives 2 and 2M, and then Alternative 4. Overall, Alternative 3 would have the least amount of visual impacts based on the activity groups above, followed in ascending order by Alternatives 1, 2M, 2, and 4.

A comparison of the alternative potential impacts to scenic resources is complicated by the fact that the effects are not the same for each activity group. Visual effects of intermediate treatments cannot be considered on an equal basis with even-aged regeneration harvests. The visual effects of even-aged regeneration harvests are likely to be obvious and longer term. Intermediate treatments are likely to be subtler in appearance and more short term in duration.

Similarly, the effects of fire treatments would generally be much shorter in duration than those of even-aged regeneration harvests. The alternatives presenting the highest levels of potential visual effects are likely to be the ones that present the highest levels of even-aged regeneration harvest. Actual effects to the landscape scenery will need to be evaluated on a project level since the location of activities, the visibility and scenic integrity, cannot be determined at a forest plan level analysis.

With the highest levels of even-aged regeneration harvest, Alternative 4 could have the greatest long-term changes to the Forest landscape. Alternative 4 would produce the highest levels of short-term impacts from prescribed fire treatments, 25 times the amount from Alternatives 1 and 3. However, these effects might be offset to some extent, by reductions over time in the risk of large wildfires, which could create more visual impacts than those of prescribed fire.

Because tree and understory vegetation re-establishes itself quickly and densely on the Forest, most visual impacts would be largely indistinguishable within 10 years of a harvest or prescribed burn. Within the next 10-year period, a maximum of 5 percent of the Forest could be affected by those activities under Alternative 3, 6 percent under Alternative 1, 8 percent under Alternatives 2 and 2M, and 14 percent under Alternative 4.

It should also be noted that this analysis is not spatial and does not incorporate potential mitigation that would be used in project implementation. Some of the treatments are likely to occur in areas with low visual sensitivity or areas that allow vegetative or topographic screening techniques, which can greatly reduce visual impacts. Because mitigation potential is determined spatially on a site-specific basis, it cannot be predicted accurately in a programmatic analysis. However, it is important to note that under all alternatives, management requirements and mitigation measures would be used to address potential effects to the scenic environment. Depending on the activities proposed, these measures would include the following:

- Management activities would be designed to be consistent with the SIOs for the area.
- Areas of high scenic sensitivity would generally be avoided or screened from activities that would not meet the SIOs.
- Areas of even-aged timber management would be regenerated with tree vegetation within a maximum of five years, and openings would return to full canopy stands within 10-15 years.
- Areas of disturbed and exposed soils—such as mine sites, skid trails, or temporary roads—would typically be scarified, seeded, and mulched to promote vegetation regeneration.
- New road construction associated with timber harvest may be offset or exceeded by opportunities to decommission and obliterate old roads at the project level.
- Prescribed fire would only occur during conditions that allow for good smoke dispersal, and fires would be designed to burn understories rather than tree crowns.

The cumulative effect of these and any additional measures applied would be to keep effects from management activities on the scenic environment small in extent and short term or temporary in duration.

Changes Related To Disturbance Events

While extremely difficult to predict or model with any degree of reliability, disturbance events can have a considerable effect on the scenic landscape. Two of the most widespread landscape disturbances, insect and disease outbreaks and wildfire, were evaluated for the relative propensity to influence visual changes in the landscape. For evaluating visual effects, we will focus on those disturbance elements in forested vegetation because that is where the more long-term visual effects of these disturbance agents generally occur. Changes that occur in non-forested vegetation are usually more subtle and temporary or short term.

Insect and Disease Pathogens - Damage from insect and disease pathogens means that tree mortality can be expected to be higher than normal. The actual impact to visual resources is highly variable and dependent on a wide range of variables such as visual sensitivity of the area observed, as well as the magnitude, scale, and intensity of mortality. Impact potential generally increases with increasing tree size and density. There are also unpredictable environmental factors such as rainfall and drought conditions that could dramatically affect the actual levels of infestation and mortality. Because there are no quantifiable estimations expressed in acreages, the predicted impact on visual resources can only be expressed as function of comparative risk between alternatives.

Generally a forested setting has the ability to absorb endemic levels of mortality such that the visual impacts would be fairly minor. However, larger-scale epidemic levels of tree mortality from pathogens can result in very noticeable changes and visual effects that are usually considered negative. The perceived sensitivity to this change is also dependent on variables such as the location and visibility of areas of mostly continuous mortality. The most dramatic visual impact occurs during the first few years following stress and mortality when leaves and needles of affected trees discolor or die while the vegetation around them remains green and healthy. Once the leaves and needles fall, the visual effect is reduced somewhat, particularly in middleground or background viewing distances.

Potential pathogen impacts are expected to increase in all alternatives over time compared with the current condition. This is primarily a result of increasing stand age and density, which increases the susceptibility of trees to pathogen infestation and damage. It is expected that the lands managed with vegetation treatments that thin or regenerate stands will have lower risk of impacts, while untreated stands of high density and advanced age will have higher impact risk.

Based on suitable acres available for vegetation treatments, Alternative 3 has the highest risk of impacts from pathogens, while Alternative 4 has the lowest. Because the variations between alternatives are relatively minor, it is expected that there would be minor visual differences between alternatives related to mortality. The amount of visual change from mortality could be expected to increase somewhat. It is likely there could be an increase in localized epidemic infestations due to increased areas that have a higher level of propensity for such infestations.

Wildfire - Wildfire events affect scenic quality in the short and long term depending on the severity, intensity and scale of the event. In considering the results of this analysis, the preceding analysis addressing management activities should also be taken into consideration. For example, alternatives presenting the lowest risk for wildfire may be the result of vegetation treatments that also have visible effects on the scenic environment. In the cases of intermediate vegetation treatments and fire use, the long-term visual effects are likely to be less than those of wildfire.

The risk of pathogen infestation is expected to increase in all alternatives over time compared with the current condition. This is primarily a result of increasing stand age and density, which increases the susceptibility of trees to infestation and damage. Although uncharacteristic fire is not currently occurring on the Forest to any noticeable degree, an increase in fuel loading, particularly from dead fuels, can increase the likelihood of larger fires with more intensity occurring in the future, particularly under drought conditions.

It is expected that the lands managed with vegetation treatments that thin or regenerate stands with harvest and prescribed fire will have lower risk, while untreated stands of high density and advanced age will have higher levels of risk. Based on this assumption, Alternative 3 would have the highest risk for increasing visual landscape changes due to wildfire, followed in ascending order by Alternatives 1, 2M, 2, and 4.

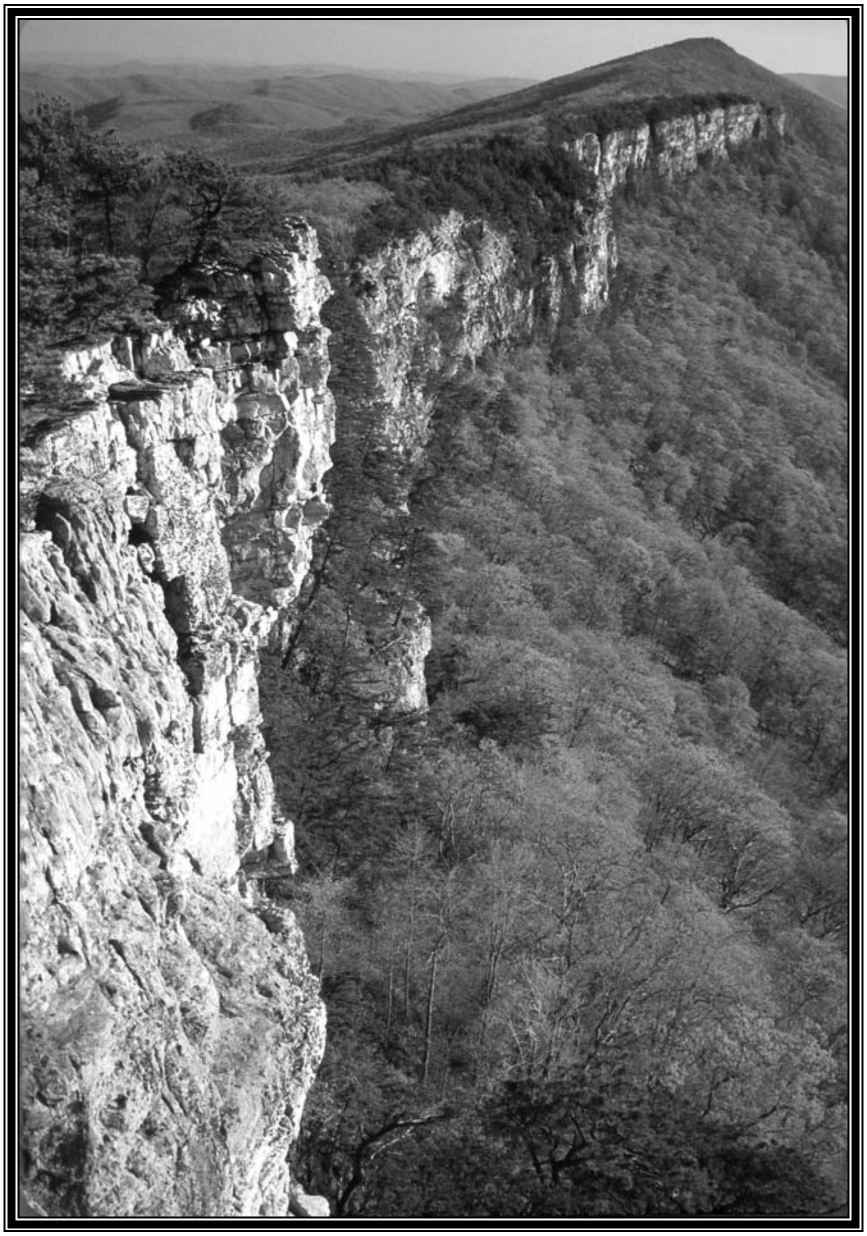
Cumulative Effects

Smoke emanating from off-Forest agricultural burning and wildfires can result in or contribute to visibility impairments in Forest areas. Normally, on-Forest prescribed fire activities are restricted whenever off-Forest sources are causing adverse effects within the vicinity. Visibility impairments due to smoke from wildfires and prescribed fire use are temporary but can affect relatively large areas.

In areas of interspersed ownership within NFS lands, there is potential for combined effects to visual resources from Forest activities and those evident on other ownership lands. In many highly scenic locations within the Forest, NFS lands are mingled with those of private lands and other government agencies. Management activities on other lands that do not blend into the landscape can negatively affect the experiences of Forest users who are viewing scenery. Although, most land management agencies follow some type of scenery management policy, no constraints apply to private lands to preserve visual qualities. Development and timber harvest on private lands adjacent to Forest are often accomplished with different objectives than on public lands. Harvest types vary on commercial private timberlands, and harvest levels generally tend to increase as federal timber supplies decrease, given stable or improving market conditions. Effects to visual resources may or may not be a consideration in the management or developments of these private lands, potentially resulting in developments that can contribute to the loss of natural-appearing landscape character.

Another recent development trend is the conversion of adjacent agricultural land to rural residences. Private land development trends generally run parallel to national economic trends, and increased with the strong economy in the late 1990s. The development of these private lands has affected the scenic quality of the landscape of the Forest as well as the experiences of scenery viewers. This development includes signs, utility lines, access roads, timber harvests, residences, and business structures. Some homeowners cut or thin their timber stands to provide views. Much private land occupies drainage bottoms and travel routes. Public desires to live in a rural, mountain environment have resulted in urbanization of some adjacent ownership. Development of agricultural lands to rural residences can result in pastoral landscapes changing to rural or, in higher density developments, near-urban landscapes. In some areas, summer home developments are defining the Forest boundaries. When structures are designed to blend into the landscape, the visual effect can be minimal. Structures and development that do not blend with the landscape can have more severe impacts. These effects are likely to vary under any alternative with the economy.

Another issue related to urbanization is the desire of property owners to preserve their scenic views of the surrounding Forest. Private lands near the Forest generally are more valuable when there is a scenic view of NFS land from the property. If management activities detrimentally alter the Forest scenery, there is potential to result in lower property values. Thus, property values may increase or decrease adjacent to the Forest depending, to some extent, upon the quality of the scenic environment.



North Fork Mountain

Road Transportation System

INTRODUCTION

Access to the Monongahela National Forest (MNF) is provided by a complex and integrated transportation system of roads under Forest Service, county, state, and private jurisdiction. The entire system of roads ranges from double-lane paved highways to narrow, native-surface roads. An estimated 1,752 miles comprise Forest roads under the jurisdiction of the Forest Service. This integrated road system connects the Forest road system to towns, communities, and major state and federal highways.

Roads are important facilities on the MNF, providing access for recreation activities, timber removal, resource utilization, wildland fire protection, and for facilities operated under special use authorizations. However, roads also have the potential to adversely affect a number of resources in various ways. Forest road systems are dynamic in that roads may be constructed or reconstructed for needed access, or they may be closed or decommissioned in an effort to reduce impacts to other resources. This analysis describes the potential effects of each alternative's management strategies on the road system rather than the effects of roads on other resources. Analysis of the effects of roads on other resources can be found in the corresponding resource sections in this chapter.

In Forest Plan revision, roads are addressed at the programmatic scale rather than a site-specific or individual road scale. As such, this process does not determine whether specific roads will be constructed, maintained, periodically closed, or decommissioned. Through their management direction, Forest Plans provide a basis for future project-level planning and analysis that are required to make those types of site-specific decisions.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect the road transportation system and the public access that the roads provide.

Background

Management of National Forest System (NFS) roads is an issue of national concern. Public interest in the roads within national forests is increasing, and few natural resource issues in recent years have attracted as much public scrutiny as road management. Concerns linked to the roads on NFS land include public access, resource damage, habitat loss, maintenance capabilities, and economics. Yet some level of road development is needed to produce the goods and services that Americans expect from their national forests. A long-term road strategy to address many of these issues was developed and reflected in the Forest Service Road Management Strategy adopted January 12, 2001. Sometimes referred to as the "Roads Rule", this policy established the scope and scale of roads analyses needed to inform road management decisions regarding new construction, reconstruction and decommissioning. It also established parameters for construction and reconstruction of roads within Inventoried Roadless Areas.

Comments received both externally and internally reflected two components: the number of miles of designated Forest roads that are developed, and the public access the roads provide. A number of comments focused on the amount of roads that should be maintained as part of the system. Comments were divided between those expressing the need to maintain current access and roads for resource management and recreation needs and those supporting reducing the road system to reduce impacts of roads on other resources and the need to lower road densities. Some comments expressed concern that overall access to the Forest was decreasing. Other comments expressed concern about concentrating public use on fewer and fewer acres, thus causing increased resource damage. Still other comments questioned the merits of reducing the road system in the face of expanding recreation use and access needs. Opposing comments favored a policy of "no new roads", especially in areas that are currently unroaded.

These comments led to an issue concerning the level of the managed road system on the Forest. Reducing the level of access, through management direction or decommissioning roads, would potentially:

- Concentrate use, increasing resource impacts and safety concerns in heavily used areas;
- Reduce public access and opportunity for motorized recreation:
- Reduce economic development opportunities; and
- Reduce resource management capabilities.

Conversely, continued expansion of the road system would potentially:

- Increase potential impacts to soils, water quality, and fish habitat;
- Increase fragmentation of habitat and disturbance for terrestrial wildlife species;
- Reduce opportunities for dispersed recreation away from the influence of roads;
- Increase public access for recreation and resource development; and
- Increase administrative access for management, including project work, surveys, research, monitoring, and fire suppression.

Road access on NFS land consists of two components: Classified roads, which are typically part of the National Forest Road System or roads under other jurisdiction; and unclassified roads, also known as "woods roads", which are typically user-created roads that have never been designed, constructed, or maintained. This analysis will focus on classified roads for the following reasons:

- The majority of roads on NFS land are classified roads.
- The Forest does not construct, decommission, maintain, or inventory unclassified roads.
- Most unclassified roads are in a condition that does not support full-sized vehicle access.
- Unclassified roads typically do not have the sort of design features—cut and fill slopes, culverts, and drainage structures—that could fail over time and cause resource damage.

Having said this, it is important to add that the Forest does not ignore unclassified roads in its transportation management. Unclassified roads are mapped and considered during site-specific project-level planning. For example, does the unclassified road provide access into an area the Forest wants to manage? Can the road be reconstructed up to standard to provide access and added to the transportation system, or would a different and new road location be more appropriate? Is the road currently providing vehicle access, which is contributing to resource damage, or is it overgrown and returning naturally to productivity? What is the most efficient and effective way to prevent access? All these and more factors are considered when the Forest evaluates the site-specific transportation needs of a given area.

Some respondents also expressed concern about road maintenance funding, specifically that expected road maintenance budgets may not provide for the adequate and timely maintenance of all Forest classified roads to their appropriate standard. The inability to provide an appropriate level of road maintenance may require the Forest to close roads until user safety and resource protection can be assured.

Indicators

The following indicators are used to measure the effects of management strategies on Forest roads on the Forest by alternative.

- **Potential change in Forest classified roads related to timber harvest by alternative.** This indicator is used to assess how Forest road levels may vary by alternative through the next planning period. The primary factors affecting change assessed are 1) roads associated with timber harvest, and 2) Management Prescriptions (MPs) 5.0, 5.1, 6.2, 8.1 Semi-Primitive Non-Motorized, and other special areas where new road construction is restricted.

- **Potential change in public motorized access related to MP allocation by alternative.** This indicator is used to compare the alternatives relative to what amount of the Forest is available for public motorized use. The primary factors for change assessed are MPs 4.1, 5.0, 5.1, 6.2, 6.1, some 8.0 and SPNM areas where public motorized use is restricted.

Scope of the Analysis

The affected area, for direct and indirect effects to roads, is the Forest Classified Road System within the Forest. This transportation network represents the roads that could receive impacts from both management activities and natural events. The affected area for cumulative effects includes these roads plus additional roads that lie within Forest boundaries, but that are under the jurisdiction of other agencies or governments. Cumulative effects to roads that are under other jurisdiction are addressed to lend a broader perspective to the importance of roads on the Forest and to emphasize cooperation among all local transportation resource providers. Effects are analyzed primarily for the short-term planning period (next 10-15 years), but extend as far as 50 years to examine potential trends in road mileage on the Forest.

CURRENT CONDITIONS

Forest road systems are dynamic. Forest engineering and resource personnel work together in an on-going process of transportation system planning and management. Roads are constructed and reconstructed based on established standards for their intended use and anticipated management needs. A relatively high percentage of new road construction is done in support of timber management, although roads are also constructed for recreation, special uses, mineral development, or private land access. Road reconstruction is done for a number of purposes, which include improving road conditions for driver safety and mitigating resource impacts. Road decommissioning occurs when a road is no longer needed for resource management or special access needs. Road decommissioning terminates motor vehicle use of roads no longer needed and restores ecological processes interrupted or impacted by the unneeded roads. Roads can also be candidates for decommissioning when maintenance requirements and resource impacts outweigh access needs. Decommissioning includes various levels of treatments to stabilize and rehabilitate unneeded roads such as blocking the entrance, revegetating and water barring, removing fills and culverts, re-establishing drainage-ways, and removing unstable road shoulders, or full obliteration by recontouring and restoring natural slopes. A site-specific analysis is required for all road construction, reconstruction, or decommissioning on the Forest.

Road activity levels vary greatly from year to year, depending on the number and type of projects that are approved for implementation. In fiscal year 2004, for example, no new roads were constructed and no roads were decommissioned, due in large part to the project moratorium that was created by the Forest Plan amendment process for threatened and endangered species. Implementation is typically dependent on agency priorities, allocated funding levels, and the level of public controversy with proposed projects.

In 1999, the Forest Service initiated a process to develop a new road management policy for all NFS land managed by the agency. In January 2001, the Forest Service adopted a new road management policy, which directs the agency to maintain a safe, environmentally sound road network that is responsive to public needs and affordable to manage. The new roads policy updates the previous roads policy written in the early 1970s. The purpose of the new policy is to provide guidelines for how the agency will manage existing roads. It includes an analysis process to be used before building new roads and a process for determining when roads are to be decommissioned. The policy relies on Forests conducting a science-based analysis of their long-term access needs and integrating the results of that analysis into the its planning processes. The Forest Service is committed to making the road management policy work. Transportation system management on the Forest will be consistent with the direction provided by the new policy, as seen in the management direction for Roads and Facilities in the 2006 Forest Plan.

Existing Road System

Most of the administrative, commercial, and public travel on the Forest occurs on the National Forest System road network of classified roads. Access to the Forest is provided largely by a combination of classified roads under Forest Service jurisdiction, federal and state highways, and other roads under state jurisdiction. In some locations, access is provided through roads that are constructed and maintained in partnership or cooperation with other agencies or permittees when access is of mutual benefit to both parties. User-created or “woods” roads also exist.

Through transportation analysis, public access opportunities are analyzed and may be provided along with controls and restrictions necessary to achieve land management objectives. The Forest has determined classified roads are needed on NFS land for public access or resource management needs, and many are open and available for public use. Others have been temporarily closed to reduce or prevent impacts to other resources. Information on open and closed roads on the Forest is made available through the District Ranger offices.

Forest roads provide access in a branching system of arterial, collector, and local roads. Arterials provide access to large land areas, typically by linking to highways or communities. They have the highest standards for construction and maintenance because of the large volume of traffic they carry. Collector roads disperse traffic from arterials to smaller Forest areas such as watersheds. They usually connect arterial roads to local Forest roads. Local roads, used to access specific project areas or sites may be of a lower standard of construction. Table RO-1 displays the total miles of Forest roads under Forest Service jurisdiction on the Forest by functional class.

Table RO-1. Estimated Miles of National Forest System Classified Roads Within Forest Service Jurisdiction*

Arterial	Collector	Local	Total
233	630	889	1,752

*Source is the FY 2004 INFRA Summary Report.

In some areas, “roads” develop not through planning, design, and construction, but through repeated passage of vehicles traveling off of transportation system roads. These unplanned travel ways are commonly called a number of names, including “woods roads”, “ghost roads” and “two-tracks”. They are not considered to be part of the road system, nor are they included in the roads in Table RO-1. In this analysis, these roads are referred to as unclassified roads.

Road Maintenance

The maintenance of Forest system roads is complicated because it is often achieved through cooperation with other agencies and private citizens. In some cases, maintenance responsibilities are exchanged with other jurisdictions through maintenance agreements when such actions create efficiencies for both parties. Roads maintained by other agencies, local governments, or private organizations under road maintenance agreements are maintained according to the terms of the maintenance agreement, which may not necessarily be to established agency-set standards. Roads with different maintenance levels can have different schedules or standards for maintenance, ranging from unused roads that do not require maintenance until they are used, to heavily used roads that may require maintenance more than once a year. Maintenance levels for Forest classified roads are briefly described below.

Maintenance Level 1 – This level is assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed one year. Basic custodial maintenance may be performed to keep damage to resources to an acceptable level and to facilitate future management activities. Planned road deterioration may also occur at this level. Roads may be open and suitable for non-motorized uses.

Maintenance Level 2 – This level is assigned to roads used by high clearance vehicles. Traffic use is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log hauling may occur at this level. Many Level 2 roads are closed on the Forest and do not receive annual maintenance by the Forest Service. Closures are typically due to wildlife disturbance concerns in MP 6.1 areas, backcountry recreation emphasis in MP 6.2 areas, special uses, or mineral operations.

Maintenance Level 3 – This level is assigned to improved roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not priorities. Roads are typically low-speed, single lane with turnouts and spot surfacing. Some roads may be fully surfaced with either native or processed material.

Maintenance Level 4 – This level is assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. Some roads may be paved or dust abated.

Maintenance Level 5 – This level is assigned to roads that provide a high degree of user comfort and convenience. Normally roads are double lane and paved. Some may be aggregate surfaces and dust abated.

Road maintenance is not static. The total miles of road maintenance responsibility for 2004 are the same as those displayed in Table RO-1. However, the actual road miles maintained are displayed in Table RO-2. The reason that the “Miles of Road Maintained to Standard” are higher than the “Miles of Road Maintained” is that the maintenance standard for Maintenance Level 1 and some Maintenance Level 2 roads was “no maintenance”. The Forest was able to maintain a high percentage of its roads that are open to public use (column 3).

Table RO-2. Miles of Road Maintenance in 2004

Miles of Road Maintained	Percent of Roads Maintained	Percent of Open Roads Maintained	Miles of Road Maintained to Standard	Percent of Roads Maintained to Standard
663	38%	82%	905	52%

Roads meeting identified long-term needs but not short-term needs are often placed in a Level 1 maintenance category. This level usually involves physical closure of the road for a period of one year or longer but not decommissioning, and these roads are not open for vehicle travel until needed again. As noted above, many Maintenance Level 2 roads on the Forest are also closed to public access and are therefore only maintained periodically, or are maintained by permittees, contractors, lessees, or cooperators.

The Forest's ability to maintain its road system is dependent on a number of factors, including:

- Total miles of open roads,
- Allocated funding for road maintenance,
- Miles maintained through commercial activities, such as timber sale contracts,
- Allocated funding for road improvement projects to support other resources,
- Maintenance levels,
- Resource protection levels,
- Recreation traffic levels,
- Environmental conditions, and
- Material and labor costs.

Road maintenance budgets have fluctuated during the past 10 years. However, traffic volumes on the Forest road system have gradually increased. Because of fewer timber sales, commercial user contributions to road maintenance also have declined. This can affect not only recurrent maintenance, such as seasonal blading, but also deferred maintenance such as long-term surface replacement. Increased use can intensify the maintenance burden on state-maintained road systems, while federal budgetary constraints may concentrate maintenance priorities on roads closer to more popular areas. As a result, roads are often maintained on a priority basis. User safety, resource protection, and user comfort needs are used to prioritize roads for maintenance.

Public Motorized Access

As noted above, public motorized access is affected by Forest Classified Road Maintenance Levels; however, these levels are in turn affected by MP emphasis and direction. In particular, certain MPs have management direction that prohibits or limits public motorized use, primarily due to resource concerns or legal reasons. MPs that prohibit this use are 5.0 (Designated Wilderness), 5.1 (Recommended Wilderness), 6.2 (Backcountry Recreation), selected 8.0 (Special Areas such as National Natural Landmarks, Botanical Areas, and Candidate Research Natural Areas), and SPNM areas in the Spruce Knob-Seneca Rocks National Recreation Area. MPs that limit public motorized use, primarily to create areas of relatively low disturbance to wildlife, are 4.1 (Spruce and Spruce-Hardwood Restoration) and 6.1 (Wildlife Habitat Emphasis). How these areas vary by alternative and what that means in terms of public motorized opportunities will be assessed in the Environmental Consequences section below.

ENVIRONMENTAL CONSEQUENCES

Resource Protection Methods

Laws, Regulations, and Policies

Numerous laws, regulations, and policies govern the management of recreation resources on NFS lands. Some key examples are described below.

- The *National Forest Roads and Trails Act* of 1964 states that construction and maintenance of an adequate system of roads and trails within and near the national forest is essential to meeting the increasing demands for recreation, timber, and other resources. It authorizes and established procedures related to rights-of-way, easements, construction, and agreements.

- The *Surface Transportation Assistance Act* of 1978 establishes criteria for Forest Highways, and defines Forest roads and Forest development roads and trails.

- *36 CFR 219.11 (14-26)* describes resource management requirements that cannot be met without providing a viable transportation system.

- *36 CFR 212* provides the principal regulations for administration of the forest development transportation system.

- *Forest Service Manual 7700* (Transportation System Manual) directs national forests to plan, develop, operate, and maintain forest development transportation facilities as a system that is integrated with other public and private transportation facilities, while carrying out the direction established in the Forest Plan. It provides guidance in the form of objectives, policies, and responsibilities for transportation planning and documenting system roads.

Forest Plan Direction

Forest Plan direction requires an analysis of long-term needs prior to constructing, reconstructing, or decommissioning National Forest System roads during project-level planning. Standards and guidelines are designed to mitigate the impacts on natural resources resulting from existing and new roads and their use. Direction has also been added to the 2006 Forest Plan regarding opportunities, reasons, and techniques for road decommissioning. Road-related direction is concentrated in the Roads and Facilities section in the 2006 Forest Plan, but has also been integrated throughout a number of resources sections.

Forest Plan Implementation

Proper road management depends on current and site-specific information about biophysical conditions and the effects that roads may have on affected resources. Some of these factors are not appropriately addressed at the programmatic level, whereas other factors may be similar to all alternatives. The evaluation of project-level transportation needs is designed to address all site-related resource factors. Through this process, which would be the same for all alternatives, adjustments in road densities would be made to address resource concerns in a timely, effective, and site-specific manner. Mitigation can also be developed at the project level to protect all resources, and this mitigation would be incorporated into specific timber contract clauses or permits that operators must follow.

Finally, the 2006 Forest Plan has the following direction that would be applied to watershed or project-level planning and implementation:

Guideline	RF07	In support of road management decisions, use an interdisciplinary science-based roads analysis process such as Roads Analysis: Informing Decisions About Managing the National Forest Transportation System (USDA Forest Service 1999).
Guideline	RF08	Evaluate existing routes during transportation planning to determine whether they should be retained, reconstructed, replaced, or decommissioned. Evaluate transportation needs based on existing uses and condition, environmental and economic impacts, and compatibility with management prescriptions. Coordinate evaluation with information in the Roads Analysis Report for the Monongahela National Forest (January 2003) or updated versions.
Guideline	RF09	During watershed or project-level analysis, opportunities for road decommissioning should be identified and prioritized based on: a) Hazard assessments in the Roads Analysis Report for the Monongahela National Forest (January 2003) or updated versions b) Identified needs in drainages with 303(d) impaired water bodies c) Prescription units that exceed road density standards for the management prescription d) Other site-specific concerns identified in the watershed or project analyses.

The *Roads Analysis Report* referred to above is a comprehensive assessment of the Maintenance Level 3, 4, and 5 roads on the Forest, including their current condition, known hazards or concerns, and recommendations for potential improvements or decommissioning.

Effects Common to All Alternatives

General Effects

Road construction and reconstruction are usually associated with development related to timber harvest, utility lines, mineral and energy exploration and production, recreation facilities, and public safety. Most of the Forest's road needs for the current level of use are in place. New road construction has been lower than was predicted for the previous planning period. Commercial use of the transportation system declined in the late 1990s and early part of this decade, and this trend may or may not continue. On the other hand, recreational traffic will likely continue to increase. This shift in traffic composition and user types is a driving force for development of new travel management philosophies and strategies.

Nationally, the trend over the past 10-15 years has been to redirect maintenance funding to decommission unneeded roads and improve the maintenance conditions of those remaining. A smaller, more efficient transportation system is the expected outcome.

Road Improvements – Road improvement projects—such as paving, graveling, or other major reconstruction—are relatively common on the Forest, and are expected to continue under any alternative. Accomplishment of these road improvements is very dependent on capital improvement funding within the agency. Priorities can also shift dramatically, for varied reasons, which may cause some projects to rise in priority or drop completely off the capital improvement list.

Recreation – Increasingly, national forests and other public land are likely to be the destinations of choice for people looking for high-quality outdoor recreation experiences in natural settings. As populations grow and visitation expands, the use of Forest roads increases. The arterials and major collectors that connect the Forest to these areas will experience the most increased day-use traffic, particularly on weekends and holidays. This traffic will add to the maintenance work necessary to keep the roads in a safe and structurally sound condition. Continued growth in recreation use without increases in the road system will likely lead to lower visitor satisfaction and more conflicts between users. New road construction for recreation purposes is expected to be very low to none, and would not vary by alternative.

Restoration Activities – Restoration activities include a broad array of management activities including timber harvest, road construction, reconstruction and decommissioning, prescribed fire, facility relocation and modification, fish habitat improvement, stream bank stabilization, slope stabilization, and mining reclamation. The effects that some of these activities may have on the transportation system are described in greater detail, below.

Timber Harvest – Historically, most Forest roads were constructed for timber management purposes. Today, timber management is still a significant contributor to the need for new road construction, although this need has declined due to a combination of reduced harvest and improved helicopter logging technology. The Forest's ability to decommission roads is also linked, to some extent, to timber sales in that funds gained through timber sales are frequently also used to decommission roads within the sale area. Road decommissioning is also funded by watershed restoration, minerals, and other sources. Timber management has also contributed to road maintenance activities on the Forest. Timber sale purchasers are usually required to perform recurrent road maintenance during timber hauling operations or post cash deposits in lieu of performance in the case of some small sales. Deferred maintenance deposits are also collected from timber sale purchasers in some cases.

Mineral and Energy Exploration, Development, and Reclamation – Road development is often associated with mineral and energy exploration and development activities. Given recent levels of these activities, relatively little development is anticipated for all of the alternatives. A site-specific analysis would be needed prior to final approval of any road development for these purposes. Reclamation activities may include re-opening closed roads or re-construction of existing ones for temporary or short-term access needs. In that the level of mineral exploration and development is largely driven by market forces and regulated by existing mining laws, there would be little difference between the alternatives in effects on the road system.

Utility Developments – These include pipelines and overhead power lines that can potentially require road construction or reconstruction for the installation and/maintenance of developed facilities. In some cases, helicopters can be used effectively to reduce new road construction needs. Little road construction and reconstruction associated with utility development is anticipated for all alternatives, and any that occurs would not likely differ by alternative.

Telecommunications Sites – Sites include communications developments that can potentially require road construction or reconstruction for the installation and/maintenance of developed facilities. In some cases, helicopters can be used effectively to reduce new road construction needs. Little or no road construction and reconstruction associated with telecommunication site development is anticipated for all alternatives. A site-specific analysis would be needed prior to final approval of any telecommunications site development.

Fish and Wildlife Habitat Protection and Watershed Improvement – These management activities can include both road management and road improvement activities done for watershed restoration. In some cases, road management measures reduce access where wildlife habitat or watershed improvement is emphasized. Some roads are closed or decommissioned upon conclusion of the primary purpose activities, while others are managed with seasonal closures in an effort to protect wildlife or their habitat. Usually, these considerations are made during project planning as part of determining transportation system needs for project implementation.

Road improvements done for fisheries and watershed restoration can include a variety of road-related activities such as culvert replacements and road re-alignments. Generally, these road improvements are designed to reduce impacts, such as sediment delivery from existing roads to streams and fish habitat.

Direct and Indirect Effects by Alternative

Potential Change in Forest Classified Roads Related to Timber Harvest by Alternative

As noted above, new road construction over the planning period is most likely to be associated with timber harvest. Estimated acres of timber harvest by alternative are shown in Table RO-3.

Table RO-3. Acres of Projected Maximum Timber Harvest by Alternative in the First Planning Decade

Estimated Maximum Harvest Acres for the Next Decade by Alternative				
Alternative 1	Alternative 2	Alternative 2M	Alternative 3	Alternative 4
54,821	45,297	45,338	40,764	51,573

Based on this relative comparison, the most road construction and reconstruction for timber-related purposes would likely occur in Alternative 1, followed in order by Alternatives 4, 2M, 2 and 3. Under every alternative, various levels of road construction, reconstruction, or decommissioning would likely occur, but those levels are unknown and cannot be accurately predicted at this scale. New roads would be built as needed, while others are decommissioned. Levels of new road construction and decommissioning vary greatly on a yearly basis due to a number of factors, including fluctuations in funding and project-level implementation schedules. Usually, classified roads that are decommissioned are local roads rather than arterial or collector roads. This is due to a number of factors, including that arterial and collectors are relatively fewer in number, receive significantly higher traffic levels, and provide access to developed facilities or serve as vital transportation links between state roads or communities.

Potential Change in Forest Classified Roads Related to Harvest Distance from Roads

Comments received on the Draft EIS suggested that we provide more information on the potential for new road construction by looking at the relationship between acres harvested by alternative and how far those acres would be from existing roads. The premise behind this request is simple—the farther the harvested stands are from existing roads, the more road will be needed to access them. However, the analysis proved to be more complex that the request, given the tools and information available.

The Spectrum model formulations provided acres harvested by alternative and a rough breakdown of how far those acres were from existing Forest Service Maintenance Level 3, 4, 5 or other public roads. The breakdowns were by increments of 3/8 (0.375) mile, as most logs can be skidded over this distance without requiring a new road. Therefore, it was assumed that timber harvested from a stand having a median distance less than 3/8 mile from an existing Maintenance Level 3, 4, 5, or other public road would not require road construction or reconstruction. Incremental road mile assumptions were assigned to distances of 3/8 to 6/8 mile, 6/8 to 9/8 mile, and greater than 9/8 mile from Level 3, 4, 5, or other public roads.

Level 3, 4, 5, or other public roads were used because it was assumed that logs could be hauled on these well-maintained roads without the need for major reconstruction. It was also assumed that if Level 1 and 2 roads were used to haul timber, they would require substantial reconstruction such as brush and tree removal, culvert replacement, and new drainage structures. However, it was impossible to differentiate how many Level 3, 4, and 5 roads would be needed versus Level 1 and 2 roads. Therefore, new construction for Level 3, 4, and 5 roads, and reconstruction for Level 1 and 2 roads, were lumped together for this analysis.

It was also impossible to tell whether harvested stands would require an entirely new road for access, or whether access would include part of a new road that had been constructed to access other stands. Therefore, we did two analyses: the first assumed all harvest would be accessed by a combination of new and existing Level 3, 4, 5, or other public roads and reconstructed Level 1 and 2 roads, and the second assumed all harvest would be accessed by only newly constructed Level 3, 4, and 5 roads and reconstructed Level 1 and 2 roads. These two sets of roads are used as a projected range of road miles that could occur by alternative. These ranges are provided in the last row of Tables RO-4 and RO-5, below. Table RO-4 shows maximum acres harvested and associated roads needed for the first decade of the planning horizon, while Table RO-5 shows the same information for the fifth decade (40-50 years from now) of the planning horizon.

Table RO-4. Miles of Road by Alternative for Decade 1 Based on Maximum Harvest Levels and Harvest Distance From Roads

Indicator	Distance to Road (Miles)	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Maximum Acres Harvested	0 to 3/8	44,911	42,133	42,349	39,154	45,460
	3/8 to 6/8	7,328	3,060	2,989	1,057	5,316
	6/8 to 9/8	1,482	80	0	553	500
	> 9/8	1,100	24	0	0	288
	Totals	54,821	45,297	45,338	40,764	51,573
Harvest Using New and Existing Maintenance Level 3, 4, and 5 Roads, and Reconstructing Existing Maintenance Level 1 and 2 Roads	0 to 3/8	0.0	0.0	0.0	0.0	0.0
	3/8 to 6/8	15.4	6.4	6.4	2.3	11.3
	6/8 to 9/8	3.4	0.4	0.0	1.5	1.1
	> 9/8	2.6	0.4	0.0	0.0	0.8
	Totals	21.4	7.1	6.4	3.8	13.1
Harvest Using New Maintenance Level 3, 4, and 5 Roads, and Reconstructing Existing Maintenance Level 1 and 2 Roads	0 to 3/8	0.0	0.0	0.0	0.0	0.0
	3/8 to 6/8	15.4	6.4	6.4	2.3	11.3
	6/8 to 9/8	6.8	0.8	0.0	3.0	2.3
	> 9/8	7.9	1.1	0.0	0.0	2.3
	Totals	30.0	8.3	6.4	5.3	15.8
Estimated Range of Road Miles for the Decade		21 - 30	7 – 8	6 – 6	4 – 5	13 - 16

As shown in Table RO-4, Alternative 1, which is harvesting the most timber over the decade, would also need the most roads to harvest that timber. Alternative 1 is followed in order by Alternatives 4, 2, 2M, and 3. The reason that Alternative 1 requires so many more road miles than the other alternatives is directly related to the larger amount of harvest that is occurring beyond 3/8 mile from existing roads. Similarly, Alternative 2M would require slightly less road mileage than Alternative 2, which harvests less timber, because more stands in Alternative 2 are farther away from existing roads. That all alternatives have such a low overall need for new is closely related to the high amount of harvest close to existing roads that has been selected by the scheduling model. The tendency of the model to optimize timber production and value may be resulting in an under-estimation of road miles needed in the first decade for all alternatives.

By the fifth decade, represented in Table RO-5, road mile patterns have shifted somewhat. Alternatives 1, 2, and 2M have very similar amounts of predicted road mileage, Alternative 4 has slightly less mileage, and Alternative 3 substantially less. For all alternatives, potential road miles range from 48 to 127 for the entire decade, which averages out to 4.8 to 12.7 miles per year. More road miles are needed in all alternatives because more harvest is projected in stands farther from existing roads. The ranges of road miles for the alternatives are greater as well, indicating that there are more road options available. The overall miles reported in the fifth decade are much greater than in the first decade primarily because the optimization model is choosing to harvest a very high percentage of easily accessible stands in the first decade. This choice has the indirect effect of leaving less accessible stands to be harvested in later decades, which requires more road construction/reconstruction.

Table RO-5. Miles of Road by Alternative for Decade 5 Based on Maximum Harvest Levels and Harvest Distance From Roads

Indicator	Distance to Road (Miles)	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Maximum Acres Harvested	0 to 3/8	27,037	19,149	21,404	16,386	18,297
	3/8 to 6/8	12,364	12,586	10,401	11,468	10,777
	6/8 to 9/8	7,909	13,113	12,682	5,504	4,460
	> 9/8	10,312	7,244	7,034	5,619	10,047
	Totals	57,622	52,092	51,521	38,977	43,581
Harvest Using New and Existing Maintenance Level 3, 4, and 5 Roads, and Reconstructing Existing Maintenance Level 1 and 2 Roads	0 to 3/8	0.0	0.0	0.0	0.0	0.0
	3/8 to 6/8	25.9	26.3	21.8	24.0	22.5
	6/8 to 9/8	16.5	28.5	31.5	11.6	9.4
	> 9/8	27.0	15.4	15.0	12.4	32.6
	Totals	69.4	70.1	68.3	48.0	64.5
Harvest Using New Maintenance Level 3, 4, and 5 Roads, and Reconstructing Existing Maintenance Level 1 and 2 Roads	0 to 3/8	0.0	0.0	0.0	0.0	0.0
	3/8 to 6/8	25.9	26.3	21.8	24.0	22.5
	6/8 to 9/8	33.0	54.8	53.3	23.3	18.8
	> 9/8	65.3	46.1	45.0	36.0	63.0
	Totals	124.1	127.1	120.0	83.3	104.3
Estimated Range of Road Miles for the Decade		69–124	70–127	68–120	48–83	6 -104

If the overall road miles are somewhat under-estimated for the first decade due to model choices and tendencies, the overall road miles in the fifth decade (or any later decade, for that matter) are likely over-estimates for the following reasons:

- Miles are based on maximum projected timber harvest (ASQ), rather than actual harvest. Records (see *Timber Resources* section) show that the Forest has not harvested the ASQ in the past 20 years.

- Helicopter yarding was not factored into the analysis, even though the Spectrum model formulations estimated that 40 percent of the projected harvest would be by helicopter yarding, which requires significantly fewer roads.

- There are a number of areas on the Forest that could be harvested if the Forest were to acquire easements or rights-of-way to existing roads. These roads may or may not need to be reconstructed to haul timber, but they would not have to be constructed.

- For this exercise, a reconstructed road was given the same value or weight as a newly constructed road, whereas in reality reconstruction may often be a more cost-efficient option, depending on site-specific circumstances. This option is worth noting because reconstructed roads do not create a major new imprint on the landscape, with the associated effects of large tree removal, new cut and fill slope excavation, habitat fragmentation, etc.

Although the road miles presented are not intended to be accurate projections, the patterns and the reasons behind those patterns are important information for land managers to recognize.

Potential Change in Public Motorized Access Related to MP Allocation

Another way to look at opportunities for road construction, reconstruction, and public motorized access is by comparing the amount of land allocated by alternative to MPs that restrict these activities. These MPs are Designated Wilderness (5.0), Recommended Wilderness (5.1), Backcountry Recreation (6.2), and selected Special Areas, such as NRA backcountry recreation areas (8.1 SPNM), Ecological Areas (8.4), and Candidate Research Natural Areas (8.5). The acres of these MPs by alternative are shown in Table RO-6.

Table RO-6. Acres of MPs that would Prohibit Public Motorized Access by Alternative

Area	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
MP 5.0 Acres	78,700	78,700	78,700	78,700	78,700
MP 5.1 Acres	0	27,700	27,700	99,400	0
MP 6.2 Acres	124,500	97,500	106,800	225,900	51,000
MP 8.1 SPNM Acres	0	24,900	24,900	13,000	24,900
MPs 8.4, 8.5	2,030	2,020	3,960	2,020	2,020
Total Acres	**205,230**	**230,820**	**242,060**	**419,020**	**156,620**

Based on the areas shown in Table RO-5, the alternative that would have the most direct effect on prohibiting public motorized access is Alternative 3, followed in descending order by Alternatives 2M, 2, 1, and 4. Compared to the current condition, represented by Alternative 1, Alternatives 2 and 2M would increase the amount of land that is off-limits to public motorized access by 25,590 acres and 36,830 acres, respectively. These acres represent about 3 and 4 percent of the Forest, respectively. Alternative 3 would more than double the current acres, and the increase would represent over 23 percent of the Forest land base. Conversely, Alternative 4 would reduce the amount of land off-limits to public motorized access by 48,600 acres, or about 5 percent of the Forest. Alternative 4 would accommodate those who favor more public motorized access on the Forest, whereas those who favor less public motorized access would be best accommodated by Alternative 3, and to a much lesser extent by Alternatives 2M and 2.

Road Maintenance Capabilities

As noted previously, road maintenance capabilities are affected by a number of variables. Because budget allocations vary from year to year and Forest to Forest, it is difficult to predict future budget allocations. Also, there is no direct linkage between stated Forest Plan budget needs and what Congress eventually allocates, so there is no assurance that future budget levels will even approach those stated in Forest planning. Recent maintenance performance levels can be used in combination with anticipated road system levels to estimate the relative percent of the road system that could be maintained under each alternative. This does not account for road maintenance contributions from commercial users or road maintenance cooperators. However, commercial road maintenance contributions are currently relatively small. Based on each alternative's relative levels of mechanical vegetation treatments, Alternative 4 would probably provide greater road maintenance contributions from commercial users. Alternatives 1, 2, and 2M would provide similar levels, while Alternative 3 would provide the lowest levels. Road maintenance cooperator contributions would probably vary little by alternative and would also be relatively small.

In general, maintenance responsibilities are proportional to the size of the classified road system. This analysis assumes a static road maintenance funding level. Because Alternative 4 may result in the largest road system on the Forest, it may also result in the lowest percentage of roads maintained to standard. Conversely, Alternative 3 may result in the smallest road system. This alternative may result in the highest percentages of roads maintained to standard.

The above results may be improved, to some extent, by commercial user contributions, which are not estimated in this analysis. Commercial user contributions would contribute to meeting road maintenance standards and would be likely to be proportional to the levels of timber harvest under each alternative. In this regard, road maintenance capabilities under Alternative 4 would probably benefit to the greatest extent. However, such performance improvements are not expected to be substantial.

Cumulative Effects

Potential Change in Forest Classified Roads Related to Timber Harvest by Alternative

The actual miles of road constructed or reconstructed related to timber harvest are impossible to predict at this scale because project design, location, transportation needs, and resource concerns are unknown. However, road decommissioning or improvement opportunities may also increase in relation to the harvest-related activities for the following reasons:

- Roads constructed for timber harvest are often Maintenance Level 1 or 2 roads, which usually provide the best opportunity for decommissioning over the short and long term.
- Any proposed timber sale would be accompanied by an area-specific transportation system analysis, which would identify the minimum system needed over the long term. This analysis would also identify any existing roads in the project or watershed area that could be improved or decommissioned.
- Timber receipts could be used to fund road decommissioning or improvement projects.
- The 2006 Forest Plan has a road decommissioning objective to achieve.

Thus, the overall Forest Classified Roads related to timber harvest—including road construction, reconstruction, and decommissioning—would be cumulatively affected by project-level decisions based primarily on the following criteria:

- The amount of timber to be harvested and the current access to that timber,
- Road-related resource concerns that can be mitigated through other harvest methods,
- The long-term transportation needs in the area,
- The opportunities for decommissioning roads to provide the minimal road system needed and to meet or exceed the 2006 Forest Plan decommissioning objective.

Relative Potential Change in Public Motorized Access Related to MP Allocation

The Direct and Indirect Effects analysis looked separately at MPs on the Forest that would either prohibit or limit public motorized access through management direction. This cumulative effects assessment combines that analysis with MPs that would potentially limit public motorized access to federal lands, to give the reader a feel for how public motorized access would be affected overall by each alternative.

It is assumed, due to past history and current management direction, that harvest activities that take place in MPs 6.1 (Wildlife Habitat Emphasis) and 4.1 (Spruce and Spruce-Hardwood Restoration) would have fewer roads open to public motorized access than activities occurring in MP 3.0. In Alternative 1, Opportunity Areas (OA) 832, 837, and 838 represent threatened and endangered species habitat that would also have some access limitations, not only to protect federally listed species, but also because most of the land in these MPs came from what was originally MP 6.1 in the 1986 Forest Plan. Thus, these MPs have access restrictions in place from when they were 6.1. The restrictions would be primarily seasonal, short-term, or long-term road closures to protect wildlife from disturbance. Public motorized access on these roads would be determined through site-specific decisions coordinated with the WVDNR and/or USFWS.

Table RO-7. Acres of MPs 4.1 and 6.1 by Alternative Limiting Public Access

Area	Alternative 1	Alternative 2	Alternative 2M	Alternative 3	Alternative 4
OA 837/838 Acres	2,540	0	0	0	0
OA 832 Acres	115,530	0	0	0	0
MP 4.1 Acres	0	155,700	154,500	90,100	199,800
MP 6.1 Acres*	284,400	286,600	277,600	177,900	310,300
Total Acres	**402,470**	**442,300**	**432,100**	**268,000**	**510,100**

*Acres are given following the Forest Plan T&E Amendment, which converted many 6.1 areas to 6.3 and OA 832 areas, but did not affect how the roads are being managed.

Based on the areas shown in Table RO-7, the alternative with MP direction that would have the most effect on limiting public motorized access is Alternative 4, followed in descending order by Alternatives 2, 2M, 1, and 3. Compared to Alternative 1, the current condition, Alternatives 2M and 2 would moderately increase the amount of land that has limited public motorized access on the Forest by 28,730 acres and 39,830 acres, respectively.

Table RO-8 displays acres of all the areas that would likely affect public motorized access by alternative.

Table RO-8. Acres of Areas Prohibiting or Limiting Public Motorized Access by Alternative

Area	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
MP 5.0 Acres	78,700	78,700	78,700	78,700	78,700
MP 5.1 Acres	0	27,700	27,700	99,400	0
MP 6.2 Acres	124,500	96,200	106,800	225,900	51,000
MP 8.4 and 8.5 Acres	2,030	2,020	3,960	2,020	2,020
SPNM Acres in NRA	0	24,900	24,900	13,000	24,900
Prohibiting Acre Subtotal	**205,230**	**230,820**	**242,060**	**419,020**	**156,650**
OA 837/838 Acres	2,540	0	0	0	0
OA 832 Acres	115,530	0	0	0	0
MP 4.1 Acres	0	155,700	154,500	90,100	199,800
MP 6.1 Acres*	284,400	286,600	277,600	177,900	310,300
Limiting Acre Subtotal	**402,470**	**442,300**	**432,100**	**268,000**	**510,100**
Total Acres	**607,700**	**673,120**	**674,160**	**687,020**	**666,730**

*Acres are given following the Forest Plan T&E Amendment, which converted many 6.1 areas to 6.3 and OA 832 areas, but did not affect how the roads are being managed. See explanation below

Cumulatively, Alternative 3 would have the most overall effect on prohibiting or limiting public motorized access, and it would have by far the most effect on prohibiting access and use. Alternatives 2, 2M, and 4 would have very similar overall effects. Alternative 1 would have the least overall limiting and prohibiting acres, but would have more prohibiting acres than Alternative 4. The difference between the alternatives with the most (3) and least (1) overall prohibiting and limiting acres is around 79,000 acres, or less than 9 percent of the Forest land base. The difference between the alternatives with the most (3) and least (4) prohibiting acres, though, is over 262,000 acres, or about 28 percent of the Forest land base.

Other Factors Influencing Road System Levels and Public Motorized Access

As populations grow and visitation expands on the Forest, the use of Forest roads will increase. The Forest arterials and major collectors that connect the Forest to popular recreation areas will experience the most increased day-use traffic, particularly on weekends and holidays. This traffic adds to the maintenance work necessary to keep the roads in a safe and structurally sound condition.

As travel to and through the Forest increases, there will be an increase in impacts to surrounding public roads. Corridor H, currently under development, is expected to generate such effects. Congestion during peak summer travel months will likely increase on State Highways 28, 39, 55, and 92, as well as U.S. Routes 33, 219, 220, and 250.

Timber sale appeals and litigation have reduced commercial forest products traffic to well below what was expected under the original Forest Plan. The level of commercial forest products traffic would vary by alternative compared to current levels.

There are no new roads planned for recreation at this time.

The Forest Service is required by law to provide reasonable access to private inholdings. As ownership of these lands has changed in recent years, more interest in developing them for second homes or developed recreation areas has been seen. Pressure on the Forest to provide more than the historical, primitive, or low-standard road access may also increase. It usually is in the interest of the Forest Service to request that a public transportation authority, such as the state government, accept responsibility for management and maintenance of roads that provide access to multiple private inholdings.

The Forest Service is also required to allow reasonable access to privately owned mineral rights for exploration, development, and extraction purposes. Currently, an estimated 38 percent of the Forest has privately owned mineral rights for gas and oil, and about 24 percent of federally owned oil and gas is currently leased. The reasonably foreseeable gas development (RFD) scenario, prepared in May 1990 and updated and validated for plan revision, predicted that there may be 19 miles of road needed for potential natural gas development per decade within the Forest proclamation boundary. However, the Forest has had only 3 miles of road constructed for mineral development since 1991 (see Table MI-1 in the *Mineral Resources* section). Operators have chosen options for development that reduce the total amount of surface disturbance dedicated to gas wells and associated roads and pipelines.

There are also roads associated with certain special use authorizations. Such roads are typically not open to public motorized use.

Because mineral development and special use requests are initiated externally, it is impossible to accurately predict what specific activities would occur, where or when they would occur, or to what intensity level—and therefore what new roads may need to be constructed. However, the government can purchase mineral rights, and leases can expire and not be extended or renewed. These situations can lead to road decommissioning opportunities.

The Forest currently has an estimated 98,000 acres of NFS land (11 percent of the Forest) for which it does not have legal road access, and therefore cannot provide access for the public.

There is currently a 47-acre (about 15 miles) limitation on annual new road construction on the Forest as a result of USFWS terms and conditions for the recent Threatened and Endangered Species Amendment to the Forest Plan.

Forest Road – Maintenance Level 4

Forest Road – Maintenance Level 3

Social and Economic Environment

INTRODUCTION

The social and economic environment for Forest Plan revision encompasses the local and state settings that affect counties, communities, economies, and natural resource policies in the Monongahela National Forest region. Social and economic analyses are conducted by the Forest Service to determine what effects the agency has on local economies and the people using natural resources. The human dimension is an important part of Forest management, and impacts on local residents and economies are considered in resource decisions made in Forest Plan revision.

A social impact is a change in social and cultural conditions that directly or indirectly results from a Forest Service action. The objective of social impact analysis is to identify potential public needs and concerns that resource managers must consider in decision-making. These needs and concerns are also intended to inform decision-makers and the public of potential social effects that may occur as a result of Forest Service actions. Social and economic impacts are closely linked and interdependent. However, social impacts focus on cultural and lifestyle changes that may occur, while economic impacts occur when Forest Service actions directly or indirectly change the employment or income in an area.

Just as the Forest Service can directly or indirectly affect social and economic conditions, the agency is also affected by changes in economies, as well as changes in attitudes, values, and public desires, at both local and national scales. Conflicting opinions over the uses of public lands have increased the complexity of National Forest management, the number and types of laws governing natural resources, and the judicial interpretation of those laws. In many cases these changes have narrowed the decision space available to local managers.

Issues and Indicators

Issue Statement 1

Forest Plan management strategies may have social and economic effects on local counties and their communities.

Background to Issue #1

The social and economic environment is not directly linked to any of the Need For Change topics found in the AMS Summary (USDA Forest Service 1997) for the Forest Plan revision. However, nearly all Forest management activities have the potential to directly or indirectly affect the social and economic environment (chiefly counties and communities). These activities would be implemented under all alternatives and would differ somewhat by alternative.

Indicators for Issue #1

Indicators for this issue include county populations, lifestyles and social organization, attitudes, beliefs and values toward land use patterns, civil rights, employment and income, and federal payments to counties.

Issue Statement #2

Forest Plan management strategies may affect the financial efficiency of operating the National Forest.

Background to Issue #2

The financial efficiency of operating the National Forest is of great concern to the Forest Service and public alike. Controversy has swirled in recent years around such financial issues as "below-cost" timber sales, "subsidized" grazing, and recreation facilities that are deteriorating due to lack of maintenance or replacement funding. Financial efficiency is measured using Net Present Value, which compares both market and non-market discounted values or revenues with discounted operating costs. Revenues included in this analysis were estimated monies collected at developed campsites, receipts for timber purchases, and monies received for livestock grazing, mineral leases, and recreation use permits. The costs used in this analysis were derived from the estimated budget costs at the experienced budget levels for FY 2002.

Indicators for Issue #2

Net Present Value (NPV) for the Monongahela National Forest is measured over a 50-year time period. The main indicator used in financial efficiency analysis is NPV. NPV is an index in which discounted costs are subtracted from discounted revenues.

Scope of the Analysis

For this analysis, the size and scale of the social and economic impact study area must be large enough to capture important impacts while remaining small enough to prevent dilution of those impacts from extraneous social and economic activity. The following factors were considered in choosing the social and economic impact study area for Forest Plan revision:

1. Initial impact site
2. Residential location of labor force, including commuting areas
3. Location of supporting industries and services
4. Location of consumers/users

The initial impact site was chosen as the 10 counties containing National Forest System lands because those counties receive impacts in the form of revenue from PILT and 25 Percent Fund or Stabilized Payments. For this analysis, counties represent the best units for defining the impact area because counties are the finest unit of disbursement for PILT, 25 Percent Fund, and Stabilized Payments, and a county is the smallest standard data set in IMPLAN, the model used to calculate employment and income effects. Furthermore, Census Bureau data sets for such social indicators as population and median income and demographics are only available at the county level for West Virginia.

The initial 10-county impact area also captures most of the spending impacts from recreation (including wildlife and fish related recreation) visits occurring on the Forest, because most people who spend money while visiting the Forest are going to be spending that money in the 10-county area during their visit.

Both sawlogs and pulpwood are harvested from National Forest System lands. A large majority of sawlogs are milled at support industries within the 10-county area, whereas a large majority of pulpwood is processed outside of the 10-county area. For Alternative 2M, about three quarters of the timber volume harvested is estimated to be sawlogs, but 99 percent of the timber value harvested is estimated to be from sawlogs. The IMPLAN model used to estimate economic effects is driven by dollar value rather than quantities of products such as timber volume.

In determining whether to expand the initial impact site to include additional, surrounding counties, we also considered the location of the labor force and its associated commuting areas. The United States Census Bureau compiles County-To-County Worker Flow Files that show commuting trends between counties based on either county of residence or county of work. For capturing induced effects, the worker flows based on county of work show whether an initial study area adequately captures household purchases from workers. For the initial impact study area, 88 percent of the individuals working in the area commute within the study area, and 80 percent of the individuals working in the study area work and reside in the same county.

The social and economic impact area for this analysis consists of the 10 counties and 22 communities within the Forest's primary area of influence (see Figure SO-1). Some state and national social and economic characteristics are also presented to help provide context and perspective. Effects are described for the area of influence, and, in the case of financial efficiency, for the Forest itself. Effects for most indicators are estimated primarily for the planning period, or the next 10 years. Because social and economic change is ongoing and can be influenced by so many factors, predictions become less and less reliable over longer time frames. NPV effects are estimated over a 50-year period.

CURRENT CONDITIONS

The MNF 10-County Region

The Forest social and economic overview area includes 10 counties that have land within them administered by the Monongahela National Forest. The relationship between counties and the Forest Service is an important one, in part because of economic benefits that the counties receive from federal land managers. The 10 counties are Barbour, Grant, Greenbrier, Nicholas, Pendleton, Preston, Pocahontas, Randolph, Tucker, and Webster. The percent of land administered by the Forest in each county is shown in Table SO-2, along with the percent of each county's land within the Forest proclamation boundary.

Figure SO-1. Counties and Communities of the Monongahela NF Region

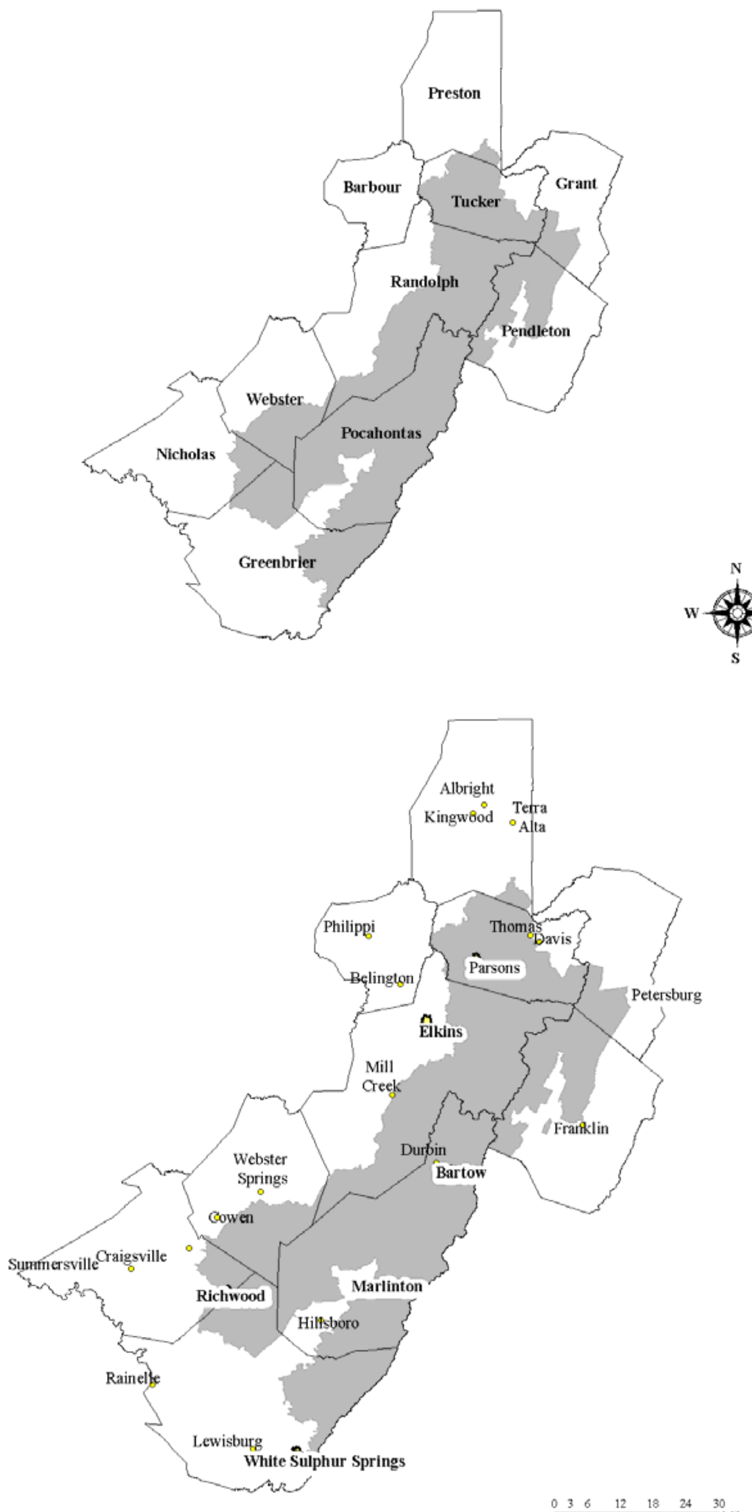


Table SO-1. Relationship between County and Monongahela NFS Lands

County	Acres	% Forested	% MNF	Acres MNF Land
Barbour	221,062	64	0.1	11
Grant	305,920	79	6.5	20,001
Greenbrier	654,592	75	16.5	108,084
Nicholas	420,333	80	5.6	23,540
Pendleton	446,033	82	18.3	81,801
Pocahontas	603,270	89	51.3	309,429
Preston	418,483	69	0.9	3,897
Randolph	669,658	88	30.4	203,407
Tucker	269,869	84	37.6	101,399
Webster	357,504	93	18.4	65,800
Totals	**4,366,724**	**78**	**21**	**917,369**

Only one of the 10 counties, Pocahontas, has over 50 percent or more of its area in MNF lands. By contrast, Barbour County has only 11 acres of MNF lands in the county's land base.

County Profiles

Brief profiles were developed for the 10 counties with the potential to be affected, from a social and economic perspective, by Forest Plan revision. They are presented below. The profile tables and the numbers in them are different than those provided in the DEIS. The differences are due to a discovery between Draft and Final that the numbers used in the DEIS spanned a period during which there was a major change in 2001 in the industrial classification systems used in economic reporting. Thus, comparing numbers used under the old Standard Industrial Classification (SIC) system to those under the new North American Industry Classification System (NAICS) was rather like comparing apples to oranges and resulted in extraordinarily high recreation sector changes, among other oddities. The numbers in the FEIS are derived from "CA25 – Total full-time and part-time employment by industry" tables published by the U.S. Department of Commerce, Bureau of Economic analysis (BEA). The years 1990 and 2000 are used to provide consistency in reporting methods and to show meaningful economic trends during this fairly recent period. Many of the tables have BEA disclosure issues, and the following definitions are useful in interpreting the specific disclosure reason:

D = Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals,
L = Less than 10 jobs, but the estimates for this item are included in the totals,
NA = Not available due to disclosure reasons noted above.

Barbour County

Formed in 1843 and consisting of 345 square miles, Barbour County was named for Virginia jurist, Philip Pendleton Barbour. Philippi, settled in 1780, is the county seat and largest town. It is also the home of Alderson-Broaddus College. The other Forest gateway community in the county is Belington. Barbour County has coal mines, tobacco farms, lumber production, and natural gas/oil wells. Its agricultural products include livestock, dairy foods, and fruit orchards.

By industry, the largest number of people in the county work in the Services sector, followed by Government, and then Retail Trade. From 1990 to 2000, the overall workforce (16 years or older) rose by 692 employees, a 14 percent increase. The largest increases in employees occurred in the Government, Finance/Insurance/Real Estate, Manufacturing, and Transportation and Utilities sectors. The largest percent increase in employment was in the Transportation and Utilities sector. The largest decreases in employees were in the Mining sector, followed by Farm Employment. The largest percent decrease in employment was also in the Mining sector.

People Employed by Place of Work in Barbour County: 1990 and 2000

Type or Place of Work	1990	2000	Decadal Change	Decadal % Change
Total full-time and part-time employment	4,829	5,521	692	14%
By Type				
Wage and salary employment	3,359	3,627	268	8%
Proprietors employment	1,470	1,894	424	29%
By Industry				
Farm employment	580	532	-48	-8%
Nonfarm employment	4,249	4,989	740	17%
Private employment	3,443	4,068	625	18%
Agricultural services, forestry, fishing & other	(D)	(D)	NA	NA
Mining	435	249	-186	-43%
Construction	200	299	99	50%
Manufacturing	214	325	111	52%
Transportation and public utilities	179	287	108	60%
Wholesale trade	80	(D)	NA	NA
Retail trade	744	826	82	11%
Finance, insurance, and real estate	153	266	113	74%
Services	(D)	1,664	NA	NA
Government and government enterprises	806	921	115	14%

Grant County

Grant County was formed in 1866 and named for General Ulysses Simpson Grant who became the 18th president of the United States. The county contains an estimated 478 square miles in the eastern part of the state. Petersburg is the county seat and also one of the sites of the Forest's Cheat-Potomac Ranger District Office. Petersburg Ranger District. It is a center for trading, tourism, and sport fishing. The county is known for its livestock, fruit and tobacco farms, grain, and timber.

By industry, the largest number of people in the county work in the Manufacturing sector, followed by the Services sector, and then Construction. Overall, the workforce decreased from 1990 to 2000 by 752 employees 16 years or older, an 11 percent reduction. The largest decreases in employment occurred in the Mining and Construction sectors. The Mining sector also had the largest percentage decrease in employment. The largest increases in employment were in the Manufacturing and Finance/ Insurance/Real Estate sectors. The largest percentage increase was in the Agriculture/Forestry/Fishing sector.

Table SO-3. People Employed by Place of Work in Grant County: 1990 and 2000

Type or Place of Work	1990	2000	Decadal Change	Decadal % Change
Total full-time and part-time employment	6,895	6,143	-752	-11%
By Type				
Wage and salary employment	5,620	4,565	-1,055	-19%
Proprietors employment	1,275	1,578	303	24%
By Industry				
Farm employment	515	505	-10	-2%
Nonfarm employment	6,380	5,638	-742	-12%
Private employment	5,393	4,625	-768	-14%
Agricultural services, forestry, fishing & other	25	72	47	188%
Mining	1,060	150	-910	-86%
Construction	1,070	629	-441	-41%
Manufacturing	683	1,146	463	68%
Transportation and public utilities	(D)	560	NA	NA
Wholesale trade	145	134	-11	-8%
Retail trade	602	607	5	1%
Finance, insurance, and real estate	198	277	79	40%
Services	(D)	1,050	NA	NA
Government and government enterprises	987	1,013	26	3%

Greenbrier County

Greenbrier County was established in 1778 and is named for the river that drains this part of the state. This large county consists of 1,023 square miles in the southeastern part of the state. Lewisburg is the county seat and largest town. Other gateway communities to the Forest are White Sulphur Springs, and Rainelle. White Sulphur Springs was the site of a District Ranger's Office for the Forest until the district merged with the Marlinton Ranger District. The Forest still has an administrative site there. The county lies in a resort region with mineral springs. It also has coal mines, lumber operations, livestock, dairy products, and fruit and tobacco farms.

By industry, the largest number of people in the county work in Services sector, followed by Retail Trade, Government, and Farming. From 1990 to 2000, the overall workforce increased by 1,520 employees 16 years or older, or by 9 percent. The largest increases in employees occurred in the Services sector, followed by the Retail Trade and Finance/Insurance/ Real Estate sectors. The largest percent increase was in the Agriculture/Forestry/Fishing sector, followed by Finance/Insurance/Real Estate. The largest decreases in employment were in the Manufacturing sector, followed by the Mining and Farm Employment. The largest percent decrease was in the Mining sector.

Table SO-4. People Employed by Place of Work in Greenbrier County: 1990 and 2000

Type or Place of Work	1990	2000	Decadal Change	Decadal % Change
Total full-time and part-time employment	16,233	17,753	1,520	9%
By Type				
Wage and salary employment	12,689	13,643	954	8%
Proprietors employment	3,544	4,110	566	16%
By Industry				
Farm employment	1,146	1,017	-129	-11%
Nonfarm employment	15,087	16,736	1,649	11%
Private employment	12,806	14,260	1,454	11%
Agricultural services, forestry, fishing & other	145	240	95	66%
Mining	425	201	-224	-53%
Construction	770	801	31	4%
Manufacturing	1,766	1,266	-500	-28%
Transportation and public utilities	664	674	10	2%
Wholesale trade	445	491	46	10%
Retail trade	2,873	3,315	442	15%
Finance, insurance, and real estate	595	865	270	45%
Services	5,123	6,407	1,284	25%
Government and government enterprises	2,281	2,476	195	9%

Nicholas County

Nicholas County was established in 1818 and named in honor of Wilson Cary Nicholas, who served as Governor of Virginia from 1814 to 1816. It consists of 657 square miles in central West Virginia. The county seat and largest town is Summersville, which sits to the north of Summersville Reservoir, a popular recreation destination. Other county gateway communities to the Forest are Craigsville and Richwood, also the site of the Forest's Gauley District Ranger Office. The county's natural resource economy includes livestock and fruit farms, tobacco crops, lumber, bituminous coal, and limestone quarries.

By industry, the largest number of people in the county work in the Retail Trade sector, followed by Services, Government, and Manufacturing. From 1990 to 2000, the overall workforce rose by 1,445 employees 16 years or older, a 15 percent increase. The largest increases in employees occurred in the Services sector, followed by Retail Trade and Government. The largest percentage increases were in the Construction sector, followed by Services and Transportation and Public Utilities. The largest losses by far were in the Mining sector, with much smaller decreases in the Wholesale Trade and Farming sectors. Mining decreased by 59 percent.

Table SO-5. People Employed by Place of Work in Nicholas County: 1990 and 2000

Type or Place of Work	1990	2000	Decadal Change	Decadal % Change
Total full-time and part-time employment	9,873	11,318	1,445	15%
By Type				
Wage and salary employment	8,284	9,444	1,160	14%
Proprietors employment	1,589	1,874	285	18%
By Industry				
Farm employment	375	372	-3	-1%
Nonfarm employment	9,498	10,946	1,448	15%
Private employment	7,790	8,900	1,110	14%
Agricultural services, forestry, fishing & other	76	88	12	16%
Mining	1,564	636	-928	-59%
Construction	331	586	255	77%
Manufacturing	1,033	1,236	203	20%
Transportation and public utilities	522	753	231	44%
Wholesale trade	316	282	-34	-11%
Retail trade	1,955	2,469	514	26%
Finance, insurance, and real estate	320	387	67	21%
Services	1,673	2,463	790	47%
Government and government enterprises	1,708	2,046	338	20%

Pendleton County

The county was founded in 1788 and named for Edmund Pendleton, the Governor of Virginia from 1774 to 1776. The county is 697 square miles in eastern West Virginia. Franklin is the county seat, and has been since 1794. The area, which contains a good portion of the Spruce Knob-Seneca Creek NRA, is known for its hunting and fishing and summer resorts. Livestock, dairy and fruit farms, and timber are also present.

By industry, the largest number of people in the county work in Services, followed by the Government, and then Farming. From 1990 to 2000, the overall workforce 16 years or older stayed relatively the same, increasing by only 9 employees. The largest increases in employees occurred in the Services sector, followed by Government and Retail Trade. The largest percentage increases were in the Retail Trade and Transportation and Utilities sectors. The largest losses in employment were in the Manufacturing sector, followed by Farming. The largest percentage decrease in employment was 77 percent of the Manufacturing sector.

Table SO-6. People Employed by Place of Work in Pendleton County: 1990 and 2000

Type or Place of Work	1990	2000	Decadal Change	Decadal % Change
Total full-time and part-time employment	3,636	3,645	9	0%
By Type				
Wage and salary employment	2,406	2,189	-217	-9%
Proprietors employment	1,230	1,456	226	18%
By Industry				
Farm employment	854	782	-72	-8%
Nonfarm employment	2,782	2,863	81	3%
Private employment	2,200	2,084	-116	-5%
Agricultural services, forestry, fishing & other	38	(D)	NA	NA
Mining	(D)	(D)	NA	NA
Construction	130	152	22	17%
Manufacturing	847	193	-654	-77%
Transportation and public utilities	119	186	67	56%
Wholesale trade	(D)	78	NA	NA
Retail trade	261	354	93	36%
Finance, insurance, and real estate	51	92	41	80%
Services	649	908	259	40%
Government and government enterprises	582	779	197	34%

Pocahontas County

Pocahontas County was established in 1821 and named after Pocahontas, the American Indian princess who was said to have saved the life of early colonist, John Smith. The county is 943 square miles and is known as the "Birthplace of Rivers", as 8 rivers have their source here. The county seat is Marlinton, named for Jacob Marlin, who settled there in 1749. The Forest's Marlinton Ranger District Office is located there. The other gateway communities are Hillsboro, the birthplace of author Pearl S. Buck, and Durbin/Bartow. Bartow is the home of the Forest's Greenbrier Ranger District Office. The county's natural resource economy includes livestock, dairy and fruit farms, and timber.

By industry, the largest number of people in the county work in the Services sector, followed by Government, Retail Trade, and Manufacturing. From 1990 to 2000, the overall workforce 16 years or older rose by 586 employees, a 12 percent increase. The largest increases in employees occurred in the Services sector, followed by Transportation and Utilities and Construction. The largest percentage increases were in Transportation and Utilities, Finance/Insurance/Real Estate, and Services. The largest losses in employment were in the Manufacturing sector, followed by Farming. The largest percentage decrease in employment was also in Manufacturing.

Table SO-7. People Employed by Place of Work in Pocahontas County: 1990 and 2000

Type or Place of Work	1990	2000	Decadal Change	Decadal % Change
Total full-time and part-time employment	4,710	5,296	586	12%
By Type				
Wage and salary employment	3,510	3,929	419	12%
Proprietors employment	1,200	1,367	167	14%
By Industry				
Farm employment	489	431	-58	-12%
Nonfarm employment	4,221	4,865	644	15%
Private employment	3,379	3,999	620	18%
Agricultural services, forestry, fishing & other	29	62	33	114%
Mining	17	(D)	NA	NA
Construction	204	299	95	47%
Manufacturing	956	585	-371	-39%
Transportation and public utilities	148	256	108	73%
Wholesale trade	56	(D)	NA	NA
Retail trade	545	595	50	9%
Finance, insurance, and real estate	162	244	82	51%
Services	1,262	1,873	611	48%
Government and government enterprises	842	866	24	3%

Preston County

Preston County was founded in 1818 and named for James Patton Preston who served as Governor of Virginia from 1816 to 1819. The county consists of 654 square miles in northern West Virginia. Kingwood, established in 1811, is the county seat and largest town. Kingwood is considered a commercial center for mining, agriculture, and lumbering. It is also a tourist attraction in summer because of its cool climate. Contributing to the county's natural resource economy are dairy and poultry farms, coal, lumber, and limestone quarries.

By industry, the largest number of people in the county work in the Services sector, followed by Government, Retail Trade, and Manufacturing. From 1990 to 2000, the overall workforce (16 years or older) rose by 1,080 employees, an 11 percent increase. The largest increases in employees occurred in the Manufacturing sector, followed by Services and Construction. The largest percentage increase was in the Agriculture/Forestry/Fishing sector, followed by Manufacturing. The largest employment losses by far were in the Mining sector, followed by small decreases in the Wholesale Trade and Transportation and Utilities sectors. The largest percentage decrease in employment, 64 percent, was in the Mining sector.

Table SO-8. People Employed by Place of Work in Preston County: 1990 and 2000

Type or Place of Work	1990	2000	Decadal Change	Decadal % Change
Total full-time and part-time employment	9,846	10,926	1,080	11%
By Type				
Wage and salary employment	7,005	7,403	398	6%
Proprietors employment	2,841	3,523	682	24%
By Industry				
Farm employment	1,041	1,093	52	5%
Nonfarm employment	8,805	9,833	1,028	12%
Private employment	7,010	8,016	1,006	14%
Agricultural services, forestry, fishing & other	68	141	73	107%
Mining	838	302	-536	-64%
Construction	470	674	204	43%
Manufacturing	770	1,390	620	81%
Transportation and public utilities	860	853	-7	-1%
Wholesale trade	263	247	-16	-6%
Retail trade	1,438	1,623	185	13%
Finance, insurance, and real estate	438	565	127	29%
Services	1,865	2,221	356	19%
Government and government enterprises	1,795	1,817	22	1%

Randolph County

Randolph County was established in 1787 and named for Edmund Jennings Randolph who served as Governor of Virginia from 1786 to 1788. Located in east central West Virginia, Randolph County is the largest county in the state at 1,046 square miles. Elkins is the county seat and home of the Monongahela National Forest's Supervisors Office, as well as Davis and Elkins College. Another gateway community in the county is Mill Creek. The county's natural resource economy includes coal mines, timber operations, limestone quarries, livestock, and fruit and tobacco farms.

By industry, the largest percentage of people in the county work in the Services sector, followed by Retail Trade, Government, and Manufacturing. From 1990 to 2000, the overall workforce 16 years or older rose by 3,227 employees, a 26 percent increase. The largest employment increases occurred in the Services sector, followed by Manufacturing, and then Retail Trade. The largest percentage increases occurred in the Manufacturing sector, followed by Services and Retail Trade. Relatively small employment losses occurred in the Transportation and Utilities sector, and in Farming.

Table SO-9. People Employed by Place of Work in Randolph County: 1990 and 2000

Type or Place of Work	1990	2000	Decadal Change	Decadal % Change
Total full-time and part-time employment	12,203	15,430	3,227	26%
By Type				
Wage and salary employment	9,846	12,620	2,774	28%
Proprietors employment	2,357	2,810	453	19%
By Industry				
Farm employment	498	490	-8	-2%
Nonfarm employment	11,705	14,940	3,235	28%
Private employment	9,668	12,629	2,961	31%
Agricultural services, forestry, fishing & other	75	(D)	NA	NA
Mining	436	(D)	NA	NA
Construction	834	898	64	8%
Manufacturing	1,236	1,995	759	61%
Transportation and public utilities	574	557	-17	-3%
Wholesale trade	489	557	68	14%
Retail trade	2,038	2,585	547	27%
Finance, insurance, and real estate	526	647	121	23%
Services	3,460	5,147	1,687	49%
Government and government enterprises	2,037	2,311	274	13%

Tucker County

Tucker County was founded in 1856 and named for Henry St. George Tucker, a prominent Virginia jurist and congressman. The county is 422 square miles and located in northeast West Virginia. Parsons is the county seat and also the office site of the Parsons Ranger District and Fernow Experimental Forest. The other gateway communities are Thomas and Davis, the latter a ski resort town. The county's economic base includes coal, limestone quarries, lumber production, livestock, dairy, and fruit farms.

By industry, the highest percentage of people in the county work in the Services sector, followed by Government, Retail Trade, and Manufacturing. From 1990 to 2000, the overall workforce (16 years or older) rose by 389 employees, an 11 percent increase. The largest employment increases occurred in the Services sector, followed by Government and Retail Trade. The largest percentage increases in employment were in the Wholesale Trade and Construction sectors. Employment losses occurred in the Manufacturing and Transportation and Utilities sectors. The largest percentage decrease in employment occurred in the Transportation and Utilities sector.

Table SO-10. People Employed by Place of Work in Tucker County: 1990 and 2000

Type or Place of Work	1990	2000	Decadal Change	Decadal % Change
Total full-time and part-time employment	3,522	3,911	389	11%
By Type				
Wage and salary employment	2,857	3,175	318	11%
Proprietors employment	665	736	71	11%
By Industry				
Farm employment	217	228	11	5%
Nonfarm employment	3,305	3,683	378	11%
Private employment	2,701	2,922	221	8%
Agricultural services, forestry, fishing & other	(L)	(D)	NA	NA
Mining	76	(D)	NA	NA
Construction	229	315	86	38%
Manufacturing	577	411	-166	-29%
Transportation and public utilities	195	107	-88	-45%
Wholesale trade	37	52	15	41%
Retail trade	407	548	141	35%
Finance, insurance, and real estate	163	223	60	37%
Services	1,014	1,201	187	18%
Government and government enterprises	604	761	157	26%

Webster County

Webster County was founded in 1860 and named after Daniel Webster, an early American statesman and orator from New England. The county is 559 square miles in the central part of the state. Its county seat and largest town is Webster Springs, a rendezvous for sportsmen. The other Forest gateway community is Cowen. The county's natural resource economy is supported by bituminous coal mines, livestock, fruit and tobacco farms, and timber operations, in addition to extensive hunting and fishing.

By industry, the highest percentage of people in the county work in the Government sector, followed by Services and Manufacturing. From 1990 to 2000, the overall workforce (16 years or older) rose by 291 employees, an 11 percent increase. The largest increases in employees occurred in the Manufacturing sector, followed by the Construction and Government sectors. The largest percentage increase was in the Construction sector. Employment losses occurred in the Mining sector, followed by Farming and Retail Trade. The largest percentage loss was in the Mining sector.

Table SO-11. People Employed by Place of Work in Webster County: 1990 and 2000

Type or Place of Work	1990	2000	Decadal Change	Decadal % Change
Total full-time and part-time employment	2,707	2,998	291	11%
By Type				
Wage and salary employment	2,026	2,397	371	18%
Proprietors employment	681	601	-80	-12%
By Industry				
Farm employment	128	91	-37	-29%
Nonfarm employment	2,579	2,907	328	13%
Private employment	1,943	2,192	249	13%
Agricultural services, forestry, fishing & other	(L)	(D)	NA	NA
Mining	364	286	-78	-21%
Construction	33	130	97	294%
Manufacturing	313	466	153	49%
Transportation and public utilities	166	171	5	3%
Wholesale trade	106	(D)	NA	NA
Retail trade	368	361	-7	-2%
Finance, insurance, and real estate	69	(D)	NA	NA
Services	523	588	65	12%
Government and government enterprises	636	715	79	12%

Population and Demographics

Population information is summarized from the *Social Assessment for the Monongahela National Forest*, developed by West Virginia University (WVU 2004) for the Forest Plan revision process. This document is available in the planning record.

Table SO-12 lists population estimates for the year 2000, along with the percent change in population from 1990 to 2000 for West Virginia, and the Forest region counties and communities.

Despite the state's modest increase in population from 1990 to 2000, the Forest region counties showed almost no increase overall during the same period. However, the variation between counties and communities was considerable. Grant County had the highest increase (8.4%) among all counties, while Webster had the largest decrease (-9.4%). Community differences ranged from Albright (+32.3%) to Davis (-21.6%).

Table SO-12. Population Statistics for State, Counties, and Communities

Location	Population 2000	Percent Change 1990-2000
Barbour County	15,557	-0.9
Belington	1,803	-2.5
Philippi	2,753	-12.1
Grant County	11,299	8.4
Petersburg	2,424	2.7
Greenbrier County	34,453	-0.7
Lewisburg	3,624	3.1
Rainelle	1,576	-6.2
White Sulphur Springs	2,315	-19.1
Nicholas County	26,562	-0.8
Craigsville	2,119	5.5
Richwood	2,477	-14.2
Summersville	3,276	22.9
Pendleton County	8,196	1.8
Franklin	797	-12.8
Pocahontas County	9,131	1.8
Durbin	262	-15.8
Hillsboro	252	30.6
Marlinton	1,204	5.3
Preston County	29,334	1.0
Albright	263	32.2
Kingwood	2,938	-9.4
Randolph County	28,262	1.7
Elkins	7,032	-5.2
Mill Creek	662	-4.6
Tucker County	7,321	-5.3
Davis	624	-21.6
Parsons	1,463	1.6
Thomas	452	-21.5
Webster County	9,719	-9.4
Cowen	513	-12.2
Webster Springs	808	19.9
All Counties in Forest Region	179,834	-0.1
West Virginia	1,808,344	0.8

Other demographic information on the counties and communities is captured in the *Social Assessment for the Monongahela National Forest* (WVU 2004) and is summarized here.

Gender – All but two of the counties and two of the gateway communities have more women than men, although most counties saw the numbers of males increase between 1990 and 2000.

Age – For all counties, the age distribution is 22% children, 62% adults, and 16% seniors, which is very similar to state-wide averages. The overall age of people in the Forest counties appears to be increasing, as seen in a decrease in number of children between 1990 and 2000, and a corresponding increase in the adult and senior age categories. Younger adults in the 25 to 34 age class are the fastest decreasing portion of the population in the state and Forest counties.

Marital Status – West Virginia had a higher divorce rate from 1990-2000 than the national average, and the Forest region counties had an even higher rate. However in 2000, the married population as a whole was higher in the Forest region counties (60.6%) than the state (58.7%), and the state was higher than the national average (54.5%).

Ethnicity – West Virginia is a predominantly white state (95%), and the Forest counties are even more so (97.7%). A number of the gateway communities fall within the 99-100 percent range. The primary minorities appear to be Black/African American, followed by Hispanic. Hispanics have had the highest percentage increases in Forest counties over the recent years.

Income and Employment

Income - In 2000, West Virginia ranked last among all states in median household income at $29,696. The median household income averaged across all of the Forest counties was only $26,691, or over $3,000 less than the state average. Only Pendleton County had a median income higher than the state. However, both the state and the counties saw an increase in the median income between 1990 and 2000 that exceeded the national average. Increases varied widely for individual counties and gateway communities, and for income brackets within each. On a positive note, people living below the poverty level decreased in this period for the state and the counties, although the Forest counties average poverty level was 19.7 percent in 2000. Income generated by households in West Virginia, the 10 MNF region counties, and gateway communities is displayed by income class in the table below for the year 2000.

Table SO-13. Percentage of Households by Income Class in 2000 for West Virginia, Forest Counties and Communities

Area	Percent of Households by Income Class* in 2000.										
	<10	10-20	20-30	30-40	40-50	50-60	60-75	75-100	100-125	125-150	>150
West Virginia	15.5	18.9	16.1	13.2	10.2	7.4	7.7	6.1	2.3	0.9	1.8
Forest Counties	16.4	21.2	17.7	14.7	9.8	6.8	5.9	4.1	1.4	0.5	1.5
Barbour County	18.5	22.9	17.3	15.0	8.8	6.5	5.4	3.4	1.3	0.4	0.6
Belington	17.6	26.9	16.0	12.5	8.8	7.1	7.0	2.2	0.5	0.3	1.1
Philippi	28.1	18.3	15.3	12.2	9.0	5.4	4.4	5.3	0.6	0.8	0.5
Grant County	13.9	19.8	17.9	15.0	11.3	8.6	6.3	4.4	0.9	0.6	1.3
Petersburg	17.2	22.0	19.1	14.2	10.3	6.9	2.9	4.8	0.4	0.8	1.4
Greenbrier County	17.7	19.7	17.6	14.5	9.6	6.3	5.9	4.1	1.8	0.6	2.3
Lewisburg	20.6	21.0	13.6	8.4	12.3	3.8	6.1	4.4	3.9	0.9	5.0
Rainelle	27.9	22.9	17.7	11.2	7.4	3.5	4.2	2.7	0.7	0.3	1.6
White S.S.	19.4	19.8	16.5	14.8	9.2	6.9	6.1	5.2	1.4	0.6	0.0
Nicholas County	16.3	20.4	18.3	13.9	10.5	5.7	6.6	4.4	1.4	0.6	2.0
Craigsville	20.5	19.7	18.0	13.4	10.5	7.1	7.8	2.0	0.4	0.0	0.7
Richwood	25.7	19.8	19.7	10.3	8.7	6.4	3.4	2.9	2.0	0.0	1.2
Summersville	14.6	18.1	17.9	9.8	9.8	6.8	9.4	4.3	1.9	2.0	5.3
Pendleton County	12.6	17.5	19.1	18.2	12.2	6.9	7.0	3.1	1.1	0.6	1.9
Franklin	9.8	18.1	16.9	17.5	8.3	12.3	10.1	3.7	1.5	0.6	1.2
Pocahontas Co.	15.8	21.7	18.3	15.3	9.3	6.7	5.8	3.8	2.2	0.6	0.5
Durbin	18.6	25.4	29.7	10.2	9.3	3.4	2.5	0.8	0.0	0.0	0.0
Hillsboro	25.2	18.0	7.2	19.8	14.4	0.0	9.9	3.6	0.0	0.0	1.8
Marlinton	21.9	25.3	16.0	12.0	7.0	6.1	4.8	2.9	2.7	0.4	1.1
Preston County	14.5	22.0	17.1	14.9	11.2	7.3	6.1	4.0	1.4	0.6	1.0
Albright	13.4	27.7	31.3	14.3	4.5	6.3	2.7	0.0	0.0	0.0	0.0
Kingwood	14.8	20.5	16.7	15.0	7.5	8.7	6.0	4.1	4.3	1.0	1.4
Randolph County	13.9	21.2	18.3	15.5	8.9	7.9	6.0	5.1	1.5	0.3	1.4
Elkins	16.2	19.5	16.4	15.3	7.3	7.6	6.1	6.4	2.4	0.2	2.5
Mill Creek	15.1	25.6	22.8	10.9	12.3	7.0	3.2	2.5	0.0	0.0	0.7
Tucker County	15.8	23.2	17.0	14.3	10.5	7.5	4.5	3.2	1.4	0.7	2.0
Davis	13.2	26.8	18.1	13.6	16.7	3.1	1.7	4.2	0.3	0.0	2.1
Parsons	17.4	23.0	17.8	14.7	11.7	5.9	5.3	1.6	0.5	0.6	1.4
Thomas	14.0	26.2	22.6	11.8	9.0	4.5	6.3	1.8	2.3	0.0	1.4
Webster County	25.0	22.8	17.0	13.4	7.5	5.2	5.0	2.2	0.5	0.5	0.9
Cowen	25.9	23.2	10.7	17.4	11.6	5.4	4.9	0.9	0.0	0.0	0.0
Webster Springs	26.7	22.2	17.8	13.4	4.9	4.6	4.4	4.2	1.0	0.7	0.0

*Income classes are expressed in thousands of dollars.

Income change by households in West Virginia, the Forest region counties, and gateway communities is displayed by income class in the table below for 1990 to 2000.

Table SO-14. Percentage Change of Households by Income Class for West Virginia, Forest Counties and Communities, 1990-2000

Area	Percent Change of Households by Income Class* for 1990-2000.										
	<10	10-20	20-30	30-40	40-50	50-60	60-75	75-100	100-125	125-150	>150
West Virginia	-9.0	-5.0	-1.4	0.2	1.5	2.2	3.9	4.1	1.7	0.6	1.1
Forest Counties	-10.9	-5.2	-1.3	3.1	2.7	2.9	3.6	2.8	1.0	0.3	1.1
Barbour County	-15.5	-3.2	0.8	5.3	2.7	2.7	3.2	2.2	1.1	0.2	0.4
Belington	-14.8	-4.7	0.5	3.9	2.4	3.5	5.9	2.2	0.3	0.3	0.7
Philippi	-5.3	-5.9	-4.4	3.8	2.2	0.3	3.0	4.3	0.6	0.8	0.5
Grant County	-9.9	-4.0	-0.9	-0.1	2.2	4.4	4.0	3.1	0.3	0.5	0.6
Petersburg	-13.7	0.6	1.3	-0.1	3.2	4.9	0.6	3.0	-0.9	0.8	0.3
Greenbrier Co.	-7.1	-6.6	-2.3	2.7	2.6	2.0	3.0	2.6	1.2	0.1	1.9
Lewisburg	-3.7	2.6	1.1	-4.6	2.3	0.4	-2.7	0.1	0.9	-0.4	4.0
Rainelle	-4.7	-5.1	0.5	2.6	-0.7	0.6	3.1	1.7	0.2	0.3	1.6
White S.S.	-13.3	-2.7	-1.1	5.9	-0.3	5.2	4.2	0.8	1.4	0.2	-0.4
Nicholas County	-11.1	-7.0	0.2	3.1	3.2	1.4	4.1	3.1	0.9	0.3	1.7
Craigsville	-1.9	-8.3	-4.9	3.3	3.7	2.3	6.0	-0.4	0.4	-0.8	0.7
Richwood	-7.3	-9.5	5.9	-3.7	6.5	5.0	0.5	0.4	1.2	0.0	1.2
Summersville	-15.2	0.3	3.5	-4.8	2.1	0.6	5.0	3.0	0.6	1.3	3.7
Pendleton County	-11.5	-9.7	0.0	4.5	6.1	2.0	4.0	1.7	0.7	0.6	1.6
Franklin	-9.1	-5.5	-7.0	5.4	-3.0	7.6	7.9	2.0	0.2	0.6	0.7
Pocahontas Co.	-12.1	-7.5	-2.9	4.9	4.3	4.4	3.9	2.6	1.6	0.3	0.5
Durbin	-13.2	-9.4	15.3	4.1	3.3	1.9	-0.5	0.8	0.0	0.0	-2.3
Hillsboro	-7.3	-9.5	-14.0	11.1	9.4	-5.0	9.9	3.6	0.0	0.0	1.8
Marlinton	-12.6	-3.8	0.7	4.8	0.1	2.8	3.0	1.1	2.3	0.4	1.1
Preston County	-10.1	-3.5	-2.7	1.1	3.9	3.1	3.4	2.8	0.9	0.5	0.7
Albright	-24.8	-1.3	12.8	-0.2	4.5	6.3	2.7	0.0	0.0	0.0	0.0
Kingwood	-10.3	-4.6	0.7	0.6	1.2	3.2	2.4	1.7	3.1	1.0	0.8
Randolph County	-12.3	-6.8	-1.2	4.3	2.5	4.2	4.0	3.5	1.0	0.0	0.9
Elkins	-11.9	-7.1	-2.3	4.3	1.1	3.1	4.1	4.7	2.4	-0.4	2.0
Mill Creek	-11.0	-6.3	-0.2	0.8	6.4	5.5	2.4	2.5	-0.8	0.0	0.7
Tucker County	-13.2	7.0	-4.1	1.9	-2.9	3.4	2.3	2.6	1.1	0.5	1.4
Davis	-10.3	-12.5	4.7	3.8	9.9	-1.6	0.6	3.6	0.3	0.0	1.5
Parsons	-10.2	-7.6	-0.6	4.0	4.1	3.6	3.2	1.3	0.5	0.6	1.1
Thomas	-5.1	-5.9	6.4	0.0	-1.5	-2.8	4.3	1.0	2.3	0.0	1.4
Webster County	-12.4	-6.6	1.3	5.4	1.7	3.3	4.2	1.7	0.1	0.4	0.8
Cowen	-6.8	-5.7	-11.2	10.0	4.6	5.4	4.1	-0.3	0.0	0.0	0.0
Webster Springs	-3.9	-7.3	0.7	4.2	1.5	3.3	0.6	1.8	-0.7	0.0	0.0

*Income classes are expressed in thousands of dollars.

Employment – There is a national trend toward a service and information based economy, and this trend can be seen in West Virginia and Forest region counties as well. In 2000, over 70 percent of occupations were in the Management/Professional, Service, and Sales/Office fields in West Virginia. For the Forest region counties, the percentage was lower at 64.7 (Table SO-15). Although the percentage of agricultural-based occupations was over three times higher in the Forest region counties than the state, this percentage (2.2) was still by far the lowest compared to other sectors. Table SO-15 shows that the Management/Professional sector had the highest percentage of employment at both the state and county levels, followed in descending order by Sales/Office, Production/Transportation, Service, Construction/Extraction/Maintenance, and Farming/Forestry/Fishing.

Table SO-15. Occupation Class Percentages in 2000 for West Virginia, Forest Counties and Communities

Area	Percent by Occupation Class, 2000*					
	Management, Professional	Service	Sales, Office	Farming, Forestry, Fishing	Constuction, Extraction, Maintenance	Production, Transportation
West Virginia	27.9	16.6	26.1	0.7	12.3	16.4
Forest Counties	24.2	18.2	22.3	2.2	14.2	18.9
Barbour County	24.6	17.4	22.7	1.2	16.9	17.2
Belington	21.7	19.6	19.5	1.0	15.5	22.6
Philippi	35.6	17.5	25.4	1.2	10.0	10.2
Grant County	21.4	13.2	19.3	2.9	12.9	30.2
Petersburg	26.4	13.5	21.2	0.9	11.1	26.9
Greenbrier County	26.0	20.9	24.4	2.2	12.0	14.4
Lewisburg	43.3	15.2	31.4	0.0	5.4	4.6
Rainelle	18.0	21.1	29.3	2.0	13.1	16.4
White S.S.	19.2	37.8	22.7	0.8	9.7	9.8
Nicholas County	23,8	17.1	24.3	1.9	15.4	17.5
Craigsville	20.2	21.3	23.0	1.7	15.9	18.0
Richwood	25.4	15.5	23.2	1.4	10.3	24.2
Summersville	30.6	19.7	31.1	0.0	10.7	7.9
Pendleton County	24.8	14.7	19.1	3.3	14.2	23.9
Franklin	28.1	17.1	29.4	3.4	6.1	15.9
Pocahontas Co.	25.1	20.9	20.9	4.4	14.3	14.4
Durbin	11.5	27.4	15.9	11.5	9.7	23.9
Hillsboro	17.8	23.3	22.2	0.0	20.0	16.7
Marlinton	28.9	23.3	23.3	2.3	9.7	12.5
Preston County	21.6	17.6	22.2	1.6	15.9	21.1
Albright	16.9	11.9	18.6	1.7	15.3	35.6
Kingwood	32.1	16.2	28.8	0.0	8.5	14.4
Randolph County	26.1	18.8	22.6	1.7	11.7	19.1
Elkins	34.3	17.9	25.3	1.3	7.2	14.0
Mill Creek	12.9	18.8	20.8	5.1	12.2	30.2
Tucker County	25.8	22.1	18.3	0.9	16.4	16.5
Davis	25.4	26.8	16.7	0.0	15.3	15.7
Parsons	26.4	17.1	22.6	0.5	12.4	21.0
Thomas	17.6	32.1	18.1	1.6	13.0	17.6
Webster County	22.2	16.0	18.8	5.5	17.8	19.8
Cowen	16.7	13,8	25.9	2.9	16.7	24.1
Webster Springs	33.7	17.5	26.3	1.4	11.6	9.5

*For population of employed persons 16 years and older

Table SO-16 shows how these occupation classes changed in the decade between 1990 to 2000. The fastest growing occupation classes between 1990 and 2000 were Management/Professional, Production/Transportation, and Sales/Office, while historically dominant natural-resource-related industries like Farming/Forestry/Fishing and Construction/Extraction decreased. Although the Service class decreased slightly for the state, it showed a slight increase (0.3%) in the Forest region counties (Table SO-16).

Table SO-16. Occupation Class Change Percentages from 1990 to 2000 for West Virginia, Forest Counties and Communities

Area	Percent Change by Occupation Class, 1990-2000					
	Management, Professional	Service	Sales, Office	Farming, Forestry, Fishing	Constuction, Extraction, Maintenance	Production, Transportation
West Virginia	5.9	-0.5	0.7	-1.3	-8.6	4.4
Forest Counties	5.7	0.3	1.9	-2.4	-9.3	4.2
Barbour County	3.2	0.5	0.1	-1.9	-3.7	2.4
Belington	7.8	-7.4	-4.3	0.0	-1.4	6.2
Philippi	-5.1	-2.9	1.6	0.6	2.4	3.8
Grant County	4.8	-3.5	1.8	-4.4	-14.8	16.2
Petersburg	1.0	-7.4	1.5	-1.4	-8.8	15.5
Greenbrier County	6.5	-1.1	3.5	-2.7	-8.3	2.7
Lewisburg	7.8	-5.5	10.5	-5.2	-6.0	-0.5
Rainelle	0.0	3.6	0.9	1.7	-7.6	1.4
White S.S.	-1.6	-5.0	4.3	-0.7	1.3	1.6
Nicholas County	5.5	0.0	2.7	0.1	-8.7	1.0
Craigsville	6.8	2.5	-1.5	1.7	-5.8	-3.7
Richwood	3.6	-7.0	0.7	0.7	-12.0	14.0
Summersville	-1.0	1.0	4.8	-1.8	-1.5	-0.8
Pendleton County	9.9	4.6	5.4	-6.4	-19.8	6.2
Franklin	0.9	2.6	9.3	-0.2	-22.7	10.1
Pocahontas Co.	8.2	2.3	2.1	-3.2	-7.2	-1.9
Durbin	6.8	10.5	-2.9	3.0	-9.1	-8.2
Hillsboro	-11.9	-6.4	12.8	0.0	10.6	-5.2
Marlinton	9.9	2.0	-2.9	0.4	-14.6	5.2
Preston County	5.0	3.1	1.4	-2.3	-11.8	5.3
Albright	11.5	-10.1	-6.0	-5.2	-1.2	10.9
Kingwood	2.0	3.8	2.0	-1.4	-5.2	-1.2
Randolph County	4.4	-1.7	-0.2	-2.2	-6.3	6.2
Elkins	7.2	-5.3	-1.3	-1.2	-7.0	7.6
Mill Creek	1.6	-4.8	6.6	2.3	-20.4	16.0
Tucker County	7.3	3.2	1.4	-3.8	-9.0	1.2
Davis	2.8	-1.4	-1.5	-1.5	-2.9	4.5
Parsons	4.5	-3.1	5.8	-0.5	-9.7	3.7
Thomas	9.5	5.2	-6.5	0.7	-12.6	3.7
Webster County	7.8	1.9	1.3	0.8	-10.0	-0.8
Cowen	-2.1	-6.3	7.1	2.9	-6.2	6.0
Webster Springs	-2.6	4.1	-4.2	1.4	0.8	0.5

Federal Payments to Counties

The relationship between counties and the Forest Service is an important one, in part because of economic benefits that the counties receive directly from the federal government. These direct benefits are primarily linked to two specific funds: 25 Percent Fund/Stabilized Payments, and Payments In Lieu of Taxes (PILT). Each payment source is described below.

25 Percent Fund and Stabilized Payments – These payments are made to the State of West Virginia for redistribution to counties in proportion to the number of acres of National Forest System land within each county. These payments are limited to use for schools and roads by the

Twenty Five Percent Fund Act of May 23, 1908, except that Public Law 89-207 (4/28/65), which established the Spruce Knob-Seneca Rocks National Recreation Area, authorized their use for schools, roads, and county government in counties containing NRA lands (Grant and Pendleton). West Virginia Code 20-3-17 and 20-3-17a allocate these funds 80 percent for schools and 20 percent for roads in all counties except Grant and Pendleton, where 65 percent is allocated for schools and 35 percent for general county purposes (none for roads).

The 25 Percent Fund/Stabilized Payments are also made for Hampshire, Hardy, Pendleton, and Monroe Counties for lands located in West Virginia within the George Washington and Jefferson National Forests. These payments are not included in Table SO-17.

Table SO-17. 25 Percent Fund or Stabilized Payments to Counties, 1993-2005

County	2006 Entitlement Acres	FY 1993 1993 Dollars	FY 1993 2005 Dollars*	FY 2005 2005 Dollars	1993-2005 Nominal % Change	1993-2005 Real % Change
Barbour	11	$15	$19	$8	- 47%	- 58%
Grant	20,001	$26,574	$33,897	$43,156	62%	27%
Greenbrier	108,128	$134,921	$172,102	$218,885	62%	27%
Nicholas	23,540	$31,352	$39,992	$16,981	- 46%	- 58%
Pendleton	81,801	$108,709	$138,667	$130,659	20%	- 6%
Pocahontas	310,188	$411,125	$524,423	$666,828	62%	27%
Preston	3,897	$5,190	$6,620	$8,460	63%	28%
Randolph	203,754	$269,600	$343,896	$434,986	61%	26%
Tucker	101,399	$135,016	$172,224	$214,388	59%	24%
Webster	65,800	$87,558	$111,687	$142,318	63%	27%
Totals	918,519	$1,210,060	$1,543,528	$1,876,669	55%	22%

Source: Albuquerque Service Center, USDA Forest Service
*Dollars inflated using a computed 1.276 Implicit Price Deflator for GDP from BEA NIPA Table 1.1.9

The original 25 Percent Fund was made up of 25 percent of National Forest receipts resulting from timber, livestock grazing, recreation, land uses, and mineral operations. Timber sale receipts include the value of roads constructed by timber purchasers, and deposits for sale area betterment under provisions of the Knutson-Vandenburg (KV) Act of 1930. Beginning in fiscal year (FY) 1993, payments for receipts from federal minerals were made directly by the Minerals Management Service (National Energy Bill of 1992). Payments made by the Minerals Management Service are not included in Table SO-7 but are discussed under Cumulative Effects.

In October of 2000 the *Secure Rural Schools and Community Self-Determination (SRSCS) Act* was passed. The SRSCS Act offered counties the option of receiving the traditional 25 percent payment based on revenue, or taking a “stabilized” annual payment based on the highest three years of payments for the years 1986 through 1999. The SRSCS Act was intended as a short-term (over ten years) measure to help counties dependent on Forest Service linked revenue while they diversified their local economies. In West Virginia, seven of the 10 counties with Forest lands opted to take the stabilized payment, beginning in FY2001. These counties are Greenbrier, Pendleton, Pocahontas, Preston, Randolph, Tucker and Webster. Thus, the following table represents a mix of payment plans, based on county decisions, beginning in FY 1983.

How counties spend their funds under the stabilized (or "full") fund option, and when and how counties can opt for a different payment plan, are spelled out in the legislation. It is too complex to elaborate on here.

In 2006, the current Administration announced that the funding for the SRSCS Act had essentially run out for its final five years, and they put forth a proposal to sell federal land to acquire funding as part of the President's FY 2007 Budget. This proposal has not been approved or funded by Congress, though it has resulted in several alternative funding proposals by Congress. As of this writing, the fate of the SRSCS Act's funding is unknown. However, in the absence of a reauthorization and funding of the SRSCS Act, all counties with Monongahela NFS lands would again receive payments from the 25 Percent Fund.

Payments in Lieu of Taxes (PILT) – These payments are paid to the State of West Virginia for redistribution to the local governments of counties containing any of several specific types of federal lands, including National Forests. Counties receive payments in proportion to the amount of acreage of National Forest land within each county. These payments are made under the provisions of the Payments-in-Lieu of Taxes Act of 1976 (PL-94-565). The rate of payment is established for "entitlement acres" (lands on tax rolls at time of acquisition). PILT payments can be used for any governmental purpose. Additional payments are also made for a period of five years for lands acquired for National Forest Wildernesses. There are a number of special provisions of the law, most of which are not pertinent to West Virginia.

The actual amount of PILT payments in any year is subject to adequate Congressional appropriation of funds. Although the payments are authorized to increase over time, funds have not been appropriated to fully fund the authorized amounts in recent years.

Many counties in West Virginia, including several with Monongahela National Forest land, receive additional PILT payments for lands administered by the National Park Service, the Corps of Engineers, or the US Fish and Wildlife Service.

Payments are based on acres in Federal ownership at the beginning of the fiscal year for PILT and at the end of the fiscal year for the 25 Percent Funds, according to their respective enabling legislations. This situation results in some minor discrepancies between the entitlement acres used to figure the payments for PILT and those used for the 25 Percent Funds, as lands are often acquired in the middle of a fiscal year.

Table SO-18. Payments in Lieu of Taxes (PILT) to Counties, 1993-2006

County	2006 Entitlement Acres	FY 1993 1993 Dollars	FY 1993 2005 Dollars*	FY 2005 2005 Dollars	1993-2005 Nominal % Change	1993-2005 Real % Change
Barbour	11	$8	$10	$16	96%	54%
Grant	20,001	$7,351	$9,377	$17,976	145%	92%
Greenbrier	108,128	$75,637	$96,481	$154,197	104%	60%
Nicholas	23,540	$17,655	$22,520	$36,144	105%	60%
Pendleton	81,801	$18,899	$24,107	$76,625	305%	218%
Pocahontas	310,188	$231,316	$295,062	$376,270	63%	28%
Preston	3,897	$2,923	$3,729	$5,558	90%	49%
Randolph	203,754	$151,735	$193,550	$290,565	91%	50%
Tucker	101,399	$71,350	$91,013	$144,601	103%	59%
Webster	65,800	$49,305	$62,892	$93,834	90%	49%
Totals	918,519	626,179	798,741	1,195,786	91%	50%

Source: http://www.nbc.gov/pilt/search.cfm
*Dollars inflated using a computed 1.276 Implicit Price Deflator for GDP from BEA NIPA Table 1.1.9

Other Social Indicators

In the Forest Plan Revision process, indicators are selected to measure the effects of the Forest Plan revision alternatives on the social and economic environment. The following are the social and economic indicators that will be "tracked" for the alternatives. These indicators correspond to variables identified in Forest Service Manual (FSM) 1972.1 and 1973.2, and Forest Service Handbook (FSH) 1909.17, for social and economic analysis.

These variables include:
- Population
- Employment
- Income
- Lifestyles and social organization
- Attitudes, beliefs and values toward land use patterns
- Civil rights.

For the population indicator, current and projected populations for the 10 counties and 22 communities studied in detail are included earlier in this section. Employment and income trends are also reported for the counties and communities.

For the remaining indicators, the discussion is organized to reflect the Forest region counties and communities as a whole. The "region as a whole" was selected as the unit of measure because there is no specific data for which these indicators could be evaluated by a county or community.

Lifestyles and Social Organization

Information about lifestyles in the Monongahela area was drawn from this section's earlier discussions regarding county and community population changes.

Although the 10 industry types or 6 occupation classes are diverse, ranging from forestry to manufacturing to recreation, the people seem to share a common characteristic—an attraction to the natural setting of their communities. People cite the natural beauty of their area, as well as wildlife-related and recreational opportunities. Many express a desire to continue a “multiple-use” way of life, while recognizing that economic diversity and economic development are important.

In most areas, an increasing share of the economy is tied not to resource-related employment, but to the burgeoning service industry. With changing demographics and economies in many parts of the Forest region, people articulate the shifts and challenges their communities face. At the same time, many are proud of their counties, communities and surroundings, and want to retain viable communities for the future. Many cite a commitment of community members to help each other.

Attitudes, Beliefs, and Values Toward Land Uses Patterns

Information about land-use patterns in the Forest area was drawn from this section’s earlier discussions regarding county population changes, and comments on Forest Plan revision.

Almost all letters or comments we have received about Forest Plan revision have expressed a particular point of view toward land uses. This orientation is based on, among other things, education, experiences as a Forest user, or personal attitudes, beliefs, and values. The same land uses can be construed as favorable by one user and unfavorable by another. Wilderness is a good case in point. Many people have written in support of more wilderness on the Forest to provide for recreational use and resource protection. Some said they would like to see the entire Forest turned into one large wilderness area. However, others have told us that they think we have enough or too much wilderness, and that any additional wilderness would restrict access to the Forest for traditional uses like driving for pleasure, wildlife habitat management, or timber harvest. Timber harvest has also been a controversial topic, with some advocating the end of all tree cutting on the Forest, some focused on the elimination of clear-cutting, and some in favor of more harvest to help local economies by providing jobs, income, and valuable products.

In general, there has been support for the following land uses or associated activities:

Air quality maintenance	Biodiversity	Ecosystem health
Education and interpretation	Erosion/sediment control	Flood prevention
Cultural resource protection	Land acquisition	Law enforcement
Managed services and goods	Native species	Old growth
Partnerships/collaboration	Private lands concerns	Public involvement
Research Natural Areas	Riparian area protection	Silvicultural methods
Vegetation management	Watershed health	Diverse land allocations

There has been a consensus of non-support for the following land uses or associated activities:

Bear baiting with dogs	Habitat fragmentation	Pesticide/herbicide use

Snowmobile use

There have been very mixed reactions for the following land uses or associated activities:

Road construction
Deer control
Invasive species control
Social and economic concerns
Access
ATV or ORV use
Gas/mineral extraction
Prescribed fire
Trail uses and designations
Wilderness
Commercial logging
Horse use
Roadless areas
Visitor opportunities
Wildlife management

While there may be widespread interest in environmental and public land issues, there is often little agreement on how to resolve these issues, or what the outcome should be.

Civil Rights

Information about civil rights in the Forest area was drawn from this section's earlier discussions of state and county demographics, as well as personal contacts.

Although West Virginia and the Forest counties and communities remain largely White, there is evidence that populations are becoming slightly more diverse. Black/African Americans comprise 3.2 percent of the state's population, with the Hispanic population the second largest minority at 0.7 percent. Hispanics appear to be growing faster than any other ethnic group. Although few data are available, there is a sense that the state's minorities use and relate to National Forests in ways similar to West Virginia's predominantly white population.

Table SO-19. Ethnic Composition of West Virginia and Forest Counties and Communities

Area	Percent Ethnic Composition in 2000					
	White	Black/African American	American Indian	Asian/Pacific Islander	Other	Hispanic*
West Virginia	95.0	3.2	0.2	0.5	0.2	0.7
All Forest Counties	97.7	1.0	0.2	0.2	0.1	0.6
Barbour County	97.4	0.5	0.7	0.3	0.1	0.5
Grant County	98.3	0.7	0.3	0.2	0.1	0.5
Greenbrier County	95.2	3.0	0.3	0.2	0.2	0.7
Nicholas County	98.8	0.1	0.2	0.2	0.1	0.5
Pendleton County	96.3	2.1	0.3	0.2	0.3	0.9
Pocahontas County	98.4	0.8	0.1	0.1	0.1	0.4
Preston County	98.8	0.3	0.1	0.2	0.0	0.6
Randolph County	97.7	1.1	0.2	0.4	0.2	0.7
Tucker County	98.9	0.1	0.2	0.1	0.1	0.2
Webster County	99.2	0.0	0.1	0.1	0.0	0.4

* Hispanic composition is calculated as its own subset, as the Census Bureau does not include Hispanic as part of its ethnic categories.

Table SO-20. Ethnic Change in West Virginia and Forest Counties and Communities 1990-2000

Area	Percent Change in Ethnic Composition, 1990-2000					
	White	Black/African American	American Indian	Asian/Pacific Islander	Other	Hispanic*
West Virginia	-1.2	0.1	0.0	0.1	0.1	0.2
All Forest Counties	-0.7	0.1	0.0	0.0	0.1	0.3
Barbour County	-0.6	-0.1	-0.5	0.1	0.1	-0.2
Grant County	-0.1	-0.3	-0.1	0.0	0.1	0.4
Greenbrier County	-0.7	-0.7	0.2	0.1	0.1	0.4
Nicholas County	-0.7	0.0	0.2	-0.1	0.0	0.2
Pendleton County	-1.4	0.0	0.3	0.1	0.2	0.6
Pocahontas County	-0.4	-0.1	-0.1	0.0	0.0	0.2
Preston County	-0.3	-0.1	-0.1	0.0	0.0	0.4
Randolph County	-1.2	0.5	0.0	0.0	0.1	0.5
Tucker County	-1.0	0.0	0.0	0.1	0.1	0.2
Webster County	-0.6	-0.1	0.0	0.1	-0.1	0.3

Economic and Financial Efficiency

Economic efficiency is measured by comparing estimated Forest revenues or receipts where money changes hands to actual or estimated costs. Revenues included in this analysis were estimated monies collected at developed campsites, receipts for timber purchases, and monies received for livestock grazing, mineral leases, and special use permits. The costs used in this analysis were derived from the estimated budget costs at the experienced budget levels for FY 2002. The analysis compares the financial efficiency of the four alternatives over a 50-year period. Estimates for the calculations were determined using information from budget ledgers and forest files and entered into a Forest Service designed spreadsheet to calculate the results. Baseline conditions will be presented as part of the economic efficiency analysis in the Environmental Consequences section.

ENVIRONMENTAL CONSEQUENCES

Laws and Regulations

The USDA Forest Service is subject to a variety of laws and regulations for the management of natural resources. These laws and regulations also provide guidance to help the Forest Service fulfill its obligations to the local communities in which National Forests and Grasslands reside. The following is a list of important legal and administrative policy areas to be considered when describing economic and social effects of management actions on local communities.

- The Twenty Five Percent Fund Act of 1908 authorizes that 25 percent of the monies received during the fiscal year from each national forest shall be paid by the U.S. Treasury to the State in which the national forest is situated for the benefit of public schools and roads of the counties in which the national forest is situated.

- The National Environmental Policy Act of 1969 (NEPA) requires that consequences to the human environment be analyzed and disclosed. The extent to which these environmental factors are analyzed and discussed is related to the nature of public comments received during the public involvement process, from initial scoping through the preparation of the Final Environmental Impact Statement (FEIS).

- The Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 as amended by the National Forest Management Act (NFMA) of 1976 requires that renewable resource programs be based on a comprehensive assessment of present and anticipated uses. The demand for and supply of renewable resources must be determined through an analysis of environmental and economic impacts. Local community impacts as well as economic cost-efficiency considerations must be considered when revising a forest plan.

- The Payments in Lieu of Taxes Act of 1976 (PILT) authorizes compensation to counties in lieu of property taxes that cannot be levied against federal lands within the counties' jurisdiction.

- Executive Order 12898 requires that planning alternatives be assessed for environmental justice concerns to determine whether or not any of the alternatives disproportionately affect minority and/or low-income populations.

- The Secure Rural Schools and Community Self-Determination Act of 2000 (SRSCS) specifies how states and counties will be compensated for impacts associated with revenues generated from National Forest System lands.

These laws and other guidelines outline the need for the Forest to analyze and consider the economic and social effects of the Forest Plan on local communities.

Direct and Indirect Effects by Alternative

Population

Table SO-3, included under Current Conditions, shows population figures for each of the 10 counties. Forest Plan alternatives could have an indirect influence on county or community populations, but how and where this influence would occur cannot be predicted with any accuracy. For example, all alternatives have the potential to increase timber production, and an increase could bring more forestry and manufacturing jobs to the area. Alternative 4 would potentially increase production the most, followed in order by Alternatives 1, 2, 2M, and 3. Whether these jobs translate into population increases would depend on how much new and relatively permanent industry is created within the Forest region. Timber that is shipped and processed outside of the region may have little if any effect on local populations. Because the difference in the maximum potential of timber production between alternatives is not substantial (30 mmbf), it is doubtful that this influence on population would vary much by alternative.

Conversely, the perception of the Forest region as a retirement area or less stressful place to live may be enhanced by alternatives that emphasize backcountry recreation in a rural setting and provide less opportunity for commodity production, increased logging traffic, or smoke from prescribed fire. However, even under Alternative 4, which has the highest amount of production-related activities, over 60 percent of the Forest would receive little or no ground-disturbing activities (see *Soil Resource* section), and there would be abundant opportunities for recreation in a rural and relatively undisturbed environment. Therefore, it is doubtful that this influence on population would vary much by alternative or have much of an effect.

Lifestyles and Social Organization

Under all alternatives, rural communities would likely continue to provide some opportunities for resource-dependent lifestyles; however, these communities would also likely continue to look for opportunities to diversify their economies. All alternatives have a mix of opportunities, goods, and services that would provide some flexibility that may help communities to adapt or diversify their economies in the future. Although the differences between alternatives are not great, Alternative 4 may provide somewhat more opportunity to increase forestry-related or wood product manufacturing jobs in local communities, whereas Alternative 3 may provide more outdoor recreation or recreation-based tourism opportunities. Alternatives 2 and 2M would likely have intermediate effects compared to Alternatives 4 and 3. Alternative 1, No Action, would represent the least amount of change from the current situation. The overall effects of any alternative alone, however, would not likely have a dramatic influence on the existing lifestyles or social organization of communities in the Forest region.

Attitudes, Beliefs and Values Toward Land Use Patterns

As noted in the Current Conditions secton, rural areas within the Forest region are expected to grow only slightly over the next few decades. Many of the rural areas encompass large areas of federally-managed land. Under all alternatives, land use patterns would likely remain the same, with a mix of managed and unmanaged land. Under Alternative 4, there would likely continue to be a mix of managed and unmanaged land, with a somewhat higher percentage of managed land than under the remaining alternatives. Under Alternative 3, there might be some shift to wildland interface areas as new residents, attracted to non-motorized recreation and/or roadless features, move in. Alternatives 2 and 2M would not indicate a significant change from Alternative 1, which represents the current situation. However, despite the increase in locationally independent lifestyles such as telecommuting or entrepreneurship, it has been difficult to discern anything like a rural renaissance in West Virginia. It is more likely that there would continue to be a mix of attitudes, beliefs, and values toward land uses and patterns in local counties and communities that tend to polarize around Forest-related issues such as wilderness, commodity production, and recreation uses. These attitudes, beliefs, and values would not likely change by alternative or because of the alternatives.

Civil Rights

Under all alternatives, it is likely that the people in the Forest region will become racially more diverse, while remaining largely white and Anglo-Saxon. Although few data are available, there is a sense that the region's minorities use and relate to National Forests in ways similar to the region's predominantly white population, and that these relationships would likely continue. Effects would not likely change by alternative or because of the alternatives.

Environmental Justice - All federal actions, including forest plan revision, are required by Executive Order 12898 to address questions of equity and fairness in resource decision making. This section considers the effects of the alternatives to identify potentially disproportionate effects on minority and low-income communities. Ethnicity and income levels for local counties and communities were summarized in the Current Conditions section. There is no indication that any of the alternatives would adversely or disproportionately affect racial minorities or low income groups. If any portion of the predicted increases in employment and income reported below come to pass, they should have positive effects on local communities and counties whose current median income levels are considered well below the national average.

Employment and Income

Differences across Forest Service management alternatives are reflected in differences in potential Forest outputs. Four broad output sources are considered: timber, minerals, range, and recreation. Outputs from these sources contribute in varying degrees to local community and county economies. This discussion includes estimates of the impact of Forest Service management alternatives on the jobs and incomes of nearby communities. The need to assess local economic impacts is spelled out in Forest Planning regulations (40 CFR 1502.15 and 36 CFR 219.11(a) and 219.12(e)), and relevant portions of the Forest Service Handbook.

Time frames in Forest Planning vary, depending on what Forest Service outputs are tracked, and why they are projected. Timber inventory, for example, responds to management directions in ways that can be predicted several decades into the future. On the other hand, recreation projections for as short a time frame as five or 10 years require substantial conjecture regarding such variables as population movements and the public's taste for outdoor recreation.

Employment - The Forest generates money through various sources, and this money has the ripple effect of creating or sustaining jobs in its area of influence. These jobs were estimated by alternative using the IMPLAN model (IMPLAN Professional Version 2.0, Minnesota IMPLAN Group, Inc.) and they are displayed below in Table SO-21. The model uses the 2002 IMPLAN database of county-level business transactions.

In response to comments on the DEIS, model values used to calculate timber-related jobs (and income) were reviewed and customized to reflect differences between logging practices and values in this region and the national averages used in the IMPLAN model. The results show an overall decrease in jobs for the timber harvest source for the current condition and across all alternatives between Draft and Final. Employment related to recreation visits increased between Draft and Final, primarily due to an increase in the predicted rate of recreation use. The current condition for recreation (and wildlife and fish related) visits, however, decreased between Draft and Final because the IMPLAN spending category related to overnight on-Forest visits was removed. It was removed from consideration because this Forest has no overnight facilities such as lodges or ski resorts where significant spending would occur.

Table SO-21. Employment by Source by Alternative (Average Annual, Decade 1)

Source	Number of Forest-Linked Jobs					
	Current	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Recreation Visits	596	753	753	753	753	753
Wildlife and Fish Related Visits	240	322	322	322	322	322
Livestock Grazing	6	6	6	6	6	6
Timber Harvest	142	748	746	742	577	945
Mineral Operations	12	12	12	12	12	12
Payments to States/Counties	54	54	54	54	54	54
Other Forest Service Expenditures	253	291	283	283	271	299
Total Forest-Linked Jobs	1,303	2,186	2,176	2,172	1,995	2,391
Percent Change from Current	---	67.8%	67.0%	66.7%	53.1%	83.5%

As seen in Table SO-21, Forest Service-linked employment is expected to be relatively static under all alternatives in the next 10 years for all Forest sources except timber harvest. Livestock grazing and mineral operations are at fairly low levels on the Forest, and are not expected to increase measurably over the planning period. Payments to counties have also been stabilized in the recent past, although the situation could change in the near future (see analysis for Federal Payments to Counties, below). Recreation and Wildlife/Fish related visits are projected to increase somewhat for all alternatives due to general population and recreation interest increases, but there is no evidence to show that the visits would differ substantially from one alternative to another, as the activities these visits represent occur all over the Forest in both motorized and non-motorized forms. It is assumed that if one alternative has a shift from motorized to non-motorized ROS opportunities (or vice versa), the use would shift as well, but the overall use of a given area would not necessarily increase due to the shift. Forest Service Expenditures, on the other hand, change somewhat between alternatives based primarily on the varying amount of Forest personnel needed to implement different levels of timber operations.

Timber-related increases in employment are estimated by alternative based on maximum projected volume outputs generated by the Spectrum model to achieve desired vegetation conditions for the Forest (see *Timber Supply* section and *Appendix B* for more information on the Spectrum model and how it was used). Increases in projected employment over current levels range from 52 percent in Alternative 3, to 83 percent in Alternative 4.

It is important to note that both Spectrum and IMPLAN are comparing the current condition with the potential upper limits of production in the five alternatives. If major changes in production and jobs occur, industry would need time to adjust to capacity. IMPLAN assumes only minor changes to local industrial capacity—such as adding more workers to process more logs, or laying off workers because fewer logs are being processed—rather than large-scale adjustments such as closing or constructing processing mills.

Table SO-22 displays how the jobs generated in Table SO-21 would be distributed within the major industrial sectors found in the MNF 10-County Region.

Table SO-22. Employment by Industry Sector by Alternative (Average Annual, Decade 1)

Industry	Number of Forest-Linked Jobs					
	Current	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Agriculture	50	224	202	201	181	247
Mining	18	21	21	21	20	21
Utilities	4	7	7	7	6	8
Construction	23	29	29	29	28	31
Manufacturing	80	343	362	359	265	457
Wholesale Trade	51	79	79	79	74	85
Transportation & Warehousing	22	46	47	47	40	54
Retail Trade	232	311	311	311	302	321
Information	6	10	10	10	10	11
Finance & Insurance	7	14	14	14	12	16
Real Estate & Rental & Leasing	20	30	29	29	28	32
Professional, Scientific & Tech Services	23	34	34	34	31	37
Management of Companies	2	5	5	5	4	5
Administration and Waste Management	11	20	20	20	19	22
Educational Services	5	8	8	8	7	8
Health Care & Social Assistance	40	69	69	69	62	76
Arts, Entertainment, and Recreation	47	69	69	69	69	70
Accommodation & Food Services	422	559	559	559	553	567
Other Services	31	67	67	66	57	77
Government	209	241	236	236	229	245
Total Forest-Linked Jobs	1,301	2,185	2,177	2,172	1,995	2,389
Percent Change from Current	---	67.9%	67.3%	66.9%	53.3%	83.6%

Not all jobs are accounted for as some would fall outside of the sectors listed in the table. The Forest-linked jobs would ripple through all sectors of the economy; however, some sectors would be affected more than others. The Agriculture and Manufacturing sectors, for example, show triple or quadruple their jobs, while other sectors show more modest gains, depending on the alternative. The larger increase in the Agriculture and Manufacturing sectors are directly related to the substantial increase projected for the timber harvest source (see Table SO-21), whereas the other sectors are showing more indirect or induced effects from projected increases in all source revenues.

Income - The money and jobs that the Forest generates through its programs and payments also ripple through the economy as income. This income was estimated by alternative using the IMPLAN model and is displayed below in Table SO-23. Changes in the modeling and outputs seen between Draft and Final are explained by the same rationale as presented in the Employment section, above.

Table SO-23. Labor Income by Source by Alternative (Average Annual, Decade 1)

Source	Forest-Linked Income (in Thousands of 2005 Dollars)					
	Current	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Recreation Visits	12,921	16,348	16,348	16,348	16,348	16,348
Wildlife and Fish Related Visits	4,929	6,855	6,855	6,855	6,855	6,855
Livestock Grazing	38	38	38	38	38	38
Timber Harvest	4,629	24,846	24,546	24,390	19,201	31,062
Mineral Operations	427	427	427	427	427	427
Payments to States/Counties	2,136	2,136	2,136	2,136	2,136	2,136
Other Forest Service Expenditures	10,783	12,421	12,073	12,061	11,538	12,742
Total Forest-Linked Income	$35,863	$63,071	$62,423	$62,255	$56,544	$69,608
Percent Change from Current	---	75.9%	74.1%	73.6%	57.7%	94.1%

Similar to Forest-linked jobs, Forest-linked income is expected to be relatively static under all alternatives in the next 10 years for all Forest sources except timber harvest. Increases in projected income over current levels range from 58 percent in Alternative 3, to 94 percent in Alternative 4. The income percentage increases are somewhat higher than the job percentage increases in Table SO-21 because the additional timber and manufacturing jobs created would provide relatively high income for jobs for this region. Table SO-24 displays how the income generated in Table SO-23 would be distributed within the major industrial sectors in the area.

Table SO-24. Labor Income by Industry by Alternative (Average Annual, Decade 1)

Industry	Forest-Linked Income (in Thousands of 2005 Dollars)					
	Current	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Agriculture	1,244	8,313	7,368	7,319	6,565	9,215
Mining	1,123	1,336	1,334	1,334	1,322	1,348
Utilities	324	657	663	661	575	759
Construction	796	1,010	996	994	944	1,056
Manufacturing	2,572	10,935	11,517	11,462	8,416	14,568
Wholesale Trade	1,989	3,053	3,065	13,044	2,862	3,286
Transportation & Warehousing	667	1,483	1,518	1,513	1,267	1,774
Retail Trade	4,158	5,662	5,643	5,638	5,462	5,863
Information	190	308	307	306	283	334
Finance & Insurance	241	506	504	502	440	579
Real Estate & Rental & Leasing	315	475	468	467	432	511
Professional, Scientific & Tech Services	773	1,182	1,174	1,171	1,076	1,284
Management of Companies	136	260	260	260	232	293
Administration and Waste Management	202	340	341	341	311	375
Educational Services	73	122	121	121	111	134
Health Care & Social Assistance	1,299	2,240	2,217	2,211	2,013	2,466
Arts, Entertainment, and Recreation	903	1,323	1,323	1,322	1,313	1,334
Accommodation & Food Services	7,611	10,329	10,325	10,323	10,239	10,426
Other Services	556	1,242	1,242	1,237	1,059	1,449
Government	10,691	12,295	12,037	12,028	11,622	12,555
Total Forest-Linked Income	$35,863	$63,071	$62,423	$62,255	$56,544	$69,608
Percent Change from Current	---	75.9%	74.1%	73.6%	57.7%	94.1%

As seen in Table SO-24, Forest-linked income would ripple through all sectors of the economy; however, some sectors would be affected more than others. The Agriculture and Manufacturing sectors, for example, nearly triple or quadruple their jobs, while other sectors show more modest gains, depending on the alternative. Again, the larger increases in the Agriculture and Manufacturing sectors are directly related to the substantial increase projected for the timber harvest source (see Table SO-23), whereas the other sectors are showing more indirect or induced effects from projected increases in all source revenues.

It is important to remember that the projected employment and income increases for this analysis are based primarily on *maximum potential* timber production under each alternative projected by the Spectrum model. Timber production is the dominant influence on economic outputs. These projected outputs have been compared to current outputs that are based on actual resource production averaged over the past 10 years. The discrepancy between the outputs projected for Alternative 1, which represents the 1986 Plan as amended, and the current or actual outputs over the past 10 years is the result of many factors. These factors include but are not limited to appeals and litigation, reductions in Forest personnel, changes in law or policy, silvicultural and resource decisions made at the project level, and other Forest priorities (such as Forest Plan amendments or revision). Only time will tell how these and other factors may affect the projected outputs that are being made under this Forest Plan revision.

If the actual timber production over the past 10 years had achieved the 1986 Plan projections, it would now be very close to the Forest Plan revision estimates for Alternative 1, No Action. Indeed, many forest-level economic analyses use the No Action Alternative as the current or baseline condition for purposes of comparison. Table SO-25 shows how Alternatives 2, 2M, 3, and 4 compare with Alternative 1 under this scenario.

Table SO-25. Forest-Linked Employment and Income Comparison by Alternative, Using Alternative 1 as the Current or Baseline Condition

Indicator	Alt. 1 (Current)	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Forest-linked Jobs	2,185	2,177	2,172	1,995	2,389
Percent Change from Current	---	- 0.4%	- 0.6%	- 9%	+ 9%
Forest-linked Income ($1,000)	$63,071	$62,423	$62,255	$56,544	$69,608
Percent Change from Current	---	- 1%	- 1%	- 10%	+ 10%

Table SO-25 shows that, comparatively speaking, Alternatives 2 and 2M would potentially produce a very similar amount of jobs and 1 income as Alternative 1, with slight reductions based on timber production potential. Alternative 3 would produces 9 percent fewer jobs and 10 percent less income than Alternative 1, while Alternative 4 would produces 9 percent more jobs and 10 percent more income than Alternative 1.

Federal Payments to Counties

As noted in the Current Conditions section, the Forest makes payments to counties through two primary sources: 25% Fund/Stabilized Payments, and Payments In Lieu of Taxes (PILT).

25 Percent Fund/Stabilized Payments – These payments are made to the State of West Virginia for redistribution to counties in proportion to the number of acres of National Forest land within each county. Payments are generally limited to use for schools and roads. Following passage of the SRSCS Act, Barbour, Grant, and Nicholas Counties chose the 25 Percent Fund, while the other seven counties in the Forest region switched to Stabilized Payments. The 2005 payments from the Monongahela National Forest for all counties are shown in Table SO-26.

Table SO-26. Forest-related 25 Percent Fund/Stabilized Payments to Counties for 2005

County	Payment	% of Total
Barbour County	$8	0%
Grant County	$43,156	2%
Greenbrier County	$218,885	12%
Nicholas County	$16,981	1%
Pendleton County	$130,659	7%
Pocahontas County	$666,828	36%
Preston County	$8,460	0%
Randolph County	$434,986	23%
Tucker County	$214,388	11%
Webster County	$142,318	8%
Totals	**$1,876,669**	**100%**

Source: Albuquerque Service Center, USDA Forest Service

The total 25 Percent Fund/Stabilized Payments to the 10 counties within the Forest region are approaching two million dollars annually. These payments have been relatively steady since 2001, the year after the SRSCS Act of 2000, although they have risen slightly due to new lands acquired in federal ownership. Because 97 percent of these payments are stabilized, they may not change much by alternative over the next several years if the counties remain with Stabilized Payments, and if the SRSCS Act can be adequately funded by Congress. Currently, the funding source for the SRSCS Act is unknown, but counties would receive the 25 Percent Fund if the SRSCS Act is not funded.

If the counties that have chosen Stabilized Payments return to the 25 Percent Fund, the amounts they receive would shift to 25 percent of the annual revenues generated by the Forest. Based on estimates from the IMPLAN model, these revenues could be potentially much higher than they have been in the recent past. However, based on recent history, Forest revenues have fluctuated greatly, depending primarily on how much timber is produced. Projected timber production would be highest in Alternative 4, followed closely by Alternatives 1, 2, and 2M, which have fairly similar production potential, and then Alternative 3, which has considerably less potential.

Payments-in-Lieu of Taxes (PILT) – These payments are paid to the State of West Virginia for redistribution to the governments of counties containing specific types of federal lands, including national forests. Counties receive payments in proportion to the amount of acreage of national forest land within each county. PILT payments can be used for any governmental purpose.

The actual amount of PILT payments in any year is subject to Congressional appropriation of funds. Although the payments are authorized to increase over time, funds have not been appropriated to fully fund the authorized amounts in recent years. The 2005 payments from the Forest for all counties are shown in Table SO-27.

Table SO-27. Forest-related PILT Payments to Counties for 2005

County	Payment	% of Total
Barbour County	$16	0%
Grant County	$17,976	2%
Greenbrier County	$154,197	13%
Nicholas County	$36,144	3%
Pendleton County	$76,625	6%
Pocahontas County	$376,270	31%
Preston County	$5,558	0%
Randolph County	$290,565	24%
Tucker County	$144,601	12%
Webster County	$93,834	8%
Totals	**$1,195,786**	**100%**

Source: USDI – www.nbc.gov/pilt/search.cfm

Because these payments are solely based on the amount of federal land within each county, they would not be affected by Forest Plan alternatives, nor would they change by alternative. Based on payments received over the last 20 years, however, it is expected that PILT payments may continue to show modest increases (see Table SO-18) over the next decade under any alternative.

Economic and Financial Efficiency

The economic and financial efficiency analysis examines revenue and cost implications from the perspective of the Forest Service. It could also be said that this is the perspective of the taxpayer. We are evaluating how efficiently the Government spends money (taxes) to achieve desired conditions. Only those costs and revenues that are recorded in financial records are included in financial efficiency analysis. The Forest Service is not a business. Revenues collected are sent to the federal treasury, from where some are returned to the Forests as Trust Funds, some are returned to the States where they were generated, and some stay in the treasury to fund government programs in general. In addition, the market sets many of the prices for Forest Service provided goods and services. Some, such as grazing fees, are set by Congress.

Economic efficiency attempts to account for many of the non-market benefits, individual values, or other values, benefits, and costs that are not easily quantifiable. To this end, the Forest Service has developed resource pricing and valuation procedures. These include values where dollars do not change hands, but some relatively intangible resource output is assigned a value. For example, a wilderness visit is assigned a dollar value, even though we are not collecting fees for visiting our wilderness areas. This valuation, at this time, has not been extended to valuing the existence of some resources. For example, we recognize that many Americans are passionately concerned about wilderness or roadless areas in general, even though most Americans have not visited the roadless or wilderness areas on this Forest. Values not included in this part of the analysis are often at the center of interest and disagreement that people have about forest resource management activities. Therefore, economic efficiency should not be viewed as an ultimate answer but as one of many tools that decision makers use to gain information about resources, alternatives, and trade-offs between quantifiable costs and revenues.

Net present value (NPV) also includes a financial efficiency analysis that has outputs—including timber, grazing, and recreation—to which monetary values, or market prices, are assigned. In deriving NPV figures, costs are subtracted from revenues to yield a net value. "Future values" (i.e., revenues received in the future) are discounted using an appropriate discount rate to obtain a "present value". The costs used in this analysis are the estimated budget costs for fiscal year 2002.

Table SO-28 displays the economic and financial efficiency, and the aggregate NPV for each alternative. A 4 percent discount rate was used over a period of 50 years (2005-2054). While the planning period for the Forest Plan is 10-15 years, the NPV analysis considers costs and revenues into the future to account for long-term revenues and costs. Although the question of the appropriate discount rate to use is debatable, the four percent level is consistent with what is commonly used in evaluation of public policy. Revenues are not reduced for payments made to states and counties. The reduction of NPV in any alternative as compared to the most financially efficient solution is the economic trade-off, or opportunity cost, of achieving that alternative.

Table S0-28. Economic and Financial Efficiency by Alternative

Alternative	Assigned Values (Economic Efficiency)	Market Prices or Values vs. Costs (Financial Efficiency)	Market and Non-market Values (Net Present Value)
Alternative 1	$1,391,902	$453,373	$1,845,274
Alternative 2	$1,391,902	$428,708	$1,820,609
Alternative 2M	$1,391,902	$423,797	$1,815,699
Alternative 3	$1,391,902	$314,776	$1,706,677
Alternative 4	$1,391,902	$518,541	$1,910,442

Economic efficiency does not change by alternative because the non-market assigned values are the same for all alternatives and they are not expected to change quantifiably by alternative over time. The market value differences are primarily related to timber costs and revenues, which do vary by alternative. When combined together, all alternatives show a net positive value, but all alternatives are fairly close in NPV, with only a 12 percent difference between the highest (Alternative 4) and the lowest (Alternative 3).

Cumulative Effects

Cumulative effects analysis discusses the *context* of the alternatives' effects within the planning area. For this analysis, the area encompassed by the 10 counties and 22 communities described earlier is generally considered the cumulative effects analysis area, because it represents the contiguous geographic area most affected by social and economic changes in management of the Monongahela National Forest.

Social and economic changes in the cumulative effects analysis area are caused by actions initiated by various businesses, governments, and other organizations. Many decisions will be made over the next decade, all potentially affecting social and economic factors such as jobs and income; lifestyles; and attitudes, beliefs and values. As noted earlier in this analysis, some of these decisions arise from litigation, or new environmental regulations or analysis requirements adopted at a national level—factors outside the scope of Forest Plan revision. Specific findings for each social and economic indicator are discussed below.

Population

Between 1990 and 2000, West Virginia had the second lowest percent increase in population (0.8%) of all 50 states. Of the four censuses previous to 2000, West Virginia had a decrease in population three times. With numbers like these, the state's population is only projected to increase by 17,000 people between now and 2025—the lowest projected change of any state in the nation (Campbell 1996).

The MNF 10-County Region showed almost no (0.1%) increase in population between 1990 and 2000. This number is deceiving, however, as several counties had increases in population above that of the state average, and several had decreases in population. This localized trend will likely continue, regardless of the Forest's contribution to the region's economies. For example, the projected increase in timber production under all Forest Plan alternatives could influence industry to build a lumber mill or wood product manufacturing plant in the Forest's region, but industry would decide where or when that mill or plant would be built, and the amount of jobs it would create.

Another outside influence could be the construction of Corridor H, a large four-lane highway that would improve access to the Forest region from the Washington D.C.-Baltimore area. It is expected that Corridor H will increase visitation to the Forest, but it could also increase the attractiveness of the area for summer or retirement homes, which could affect local populations. If this should occur, the influence would likely be felt more in the northern counties of the Forest region, closer to the constructed corridor.

Lifestyles and Social Organization

Under all alternatives, the 10-county/22-community cumulative effects area would continue to provide a diversity of lifestyles, ranging from urban recreationists to farmers and loggers. Consequently, no measurable cumulative impact from any of the Forest Plan Revision alternatives is anticipated. It is more likely that local differences in lifestyles and social organization would be affected by events such as the construction of a manufacturing plant or Corridor H, as described under the Population cumulative effects, above.

Attitudes, Beliefs and Values Toward Land Use Patterns

Under all alternatives, the 10-county/22-community cumulative effects area would likely continue to exhibit widespread interest in natural resources and public land issues as well as diversity in attitudes, beliefs, and values about these resources and issues. Consequently, no measurable cumulative impact from any of the Forest Plan Revision alternatives is anticipated.

Although attitudes and beliefs tend to be polarized around such land use issues as wilderness, commodity production, or recreation uses, underlying values expressed toward community and the region tend to be similar. Most residents are proud of their communities, counties and surroundings, and would like to ensure their future viability. County commissioners and citizens alike have a mutual respect and appreciation for the land, but also a mutual interest in increasing the prosperity of their communities to maintain or improve schools, roads, and other infrastructure, to support and attract successful businesses, and to provide more opportunity for their family and friends to live, work, and play closer to home.

Civil Rights

Under all alternatives, it is likely that West Virginia would become racially more diverse, while remaining largely white and Anglo-Saxon. Although few data are available, there is a sense that the state's minorities use and relate to national forests in ways similar to the predominantly white population of the state, and that this relationship would likely continue regardless of the Forest Plan alternative selected. Consequently, no cumulative impact from any of the Forest Plan Revision alternatives is anticipated.

Employment and Income

Table SO-29 indicates the number and percentage of cumulative jobs and income in the MNF 10-County Region currently linked to Forest Service activities.

If the projected alternative outputs are fully realized, the amount and percentage of employment contribution to the 10-County Region could increase as much as seen in Table SO-30 for the first decade. Table SO-30 shows that the alternatives could potentially increase Forest-linked jobs from the current 1.9 percent to a range of 2.6 in Alternative 3 to 3.2 percent in Alternative 4. Alternatives 1, 2, and 2M make a similar 2.9 percent contribution.

Table SO-29. Current Forest-Related Contributions to the 10-County Region Economy

Industry Sector	Employment (jobs)		Labor Income ($ Thousands)	
	Area Totals	FS-Related	Area Totals	FS-Related
Agriculture	6,346	50	$59,089.2	$1,244.4
Mining	2,118	18	$132,663.9	$1,123.2
Utilities	483	4	$38,432.9	$324.1
Construction	5,111	23	$171,736.6	$796.2
Manufacturing	6,842	80	$238,584.0	$2,572.1
Wholesale Trade	1,157	51	$44,407.9	$1,989.4
Transportation & Warehousing	2,822	22	$107,467.7	$666.5
Retail Trade	8,883	232	$196,455.8	$4,158.1
Information	489	6	$17,538.2	$190.2
Finance & Insurance	1,405	7	$49,235.5	$240.5
Real Estate & Rental & Leasing	1,610	20	$35,517.0	$314.6
Professional, Scientific & Tech Services	1,888	23	$64,448.6	$773.0
Management of Companies	188	2	$8,320.8	$136.0
Administration and Waste Management	1,590	11	$27,652.4	$201.7
Educational Services	1,627	5	$23,062.0	$72.7
Health Care & Social Assistance	9,080	40	$260,673.7	$1,299.2
Arts, Entertainment, and Recreation	476	47	$10,834.7	$902.7
Accommodation & Food Services	6,475	422	$115,570.5	$7,611.0
Other Services	4,433	31	$81,747.9	$556.4
Government	12,323	209	$479,959.0	$10,691.1
Totals	75,346	1,426	$2,073,752	$35,942
Percent of Total	100.0%	1.9%	100.0%	1.7%

Table SO-30. Maximum Potential Contribution to 10-County Region Jobs by Alternative
(Average Annual, Decade 1)

Industry Sector	10-County Totals	Forest-Linked Jobs by Alternative				
		Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Agriculture	6,346	224	202	201	181	247
Mining	2,118	21	21	21	20	21
Utilities	483	7	7	7	6	8
Construction	5,111	29	29	29	28	31
Manufacturing	6,842	343	362	359	265	457
Wholesale Trade	1,157	79	79	79	74	85
Transportation & Warehousing	2,822	46	47	47	40	54
Retail Trade	8,883	311	311	311	302	321
Information	489	10	10	10	10	11
Finance & Insurance	1,405	14	14	14	12	16
Real Estate & Rental & Leasing	1,610	30	29	29	28	32
Professional, Scientific & Technical Srvs	1,888	34	34	34	31	37
Management of Companies	188	5	5	5	4	5
Administration and Waste Management	1,590	20	20	20	19	22
Educational Services	1,627	8	8	8	7	8
Health Care & Social Assistance	9,080	69	69	69	62	76
Arts, Entertainment, and Recreation	476	69	69	69	69	70
Accommodation & Food Services	6,475	559	559	559	553	567
Other Services	4,433	67	67	66	57	77
Government	12,323	241	236	236	229	245
Totals	75,346	2,185	2,177	2,172	1,995	2,389
Percent of Total MNF 10-County Region	100.0%	2.9%	2.9%	2.9%	2.6%	3.2%

We had a request in the comments on the DEIS to show how the projected employment by alternative compared to total employment in the State of West Virginia. When compared to the total jobs in West Virginia (BEA 2003), the contributions of the alternatives are insignificant and diluted, as seen in Table SO-31, and the differences between alternatives are negligible.

Table SO-31. Maximum Potential Contribution to State Jobs by Alternative
(Alternatives Average Annual, Decade 1 vs. 2003 Total State Employment from BEA)

Indicator	West Virginia	Current	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Total Jobs	885,663	1,426	2,185	2,177	2,172	1,995	2,389
Percent of State Total	100%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%

Similarly, in Table SO-32 the alternatives potentially increase all Forest-linked income from the current 1.7 percent to a range of 2.7 in Alternative 3 to 3.4 percent in Alternative 4. Again, Alternatives 1, 2, and 2M make a similar 3 percent contribution.

Table SO-32. Maximum Potential Contribution to 10-County Region Income by Alternative (Average Annual, Decade 1)

Industry Sector	10-County Totals	Forest-Linked Jobs by Alternative				
		Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Agriculture	$59,089.2	8,313	7,368	7,319	6,565	9,215
Mining	$132,663.9	1,336	1,334	1,334	1,322	1,348
Utilities	$38,432.9	657	663	661	575	759
Construction	$171,736.6	1,010	996	994	944	1,056
Manufacturing	$238,584.0	10,935	11,517	11,462	8,416	14,568
Wholesale Trade	$44,407.9	3,053	3,065	13,044	2,862	3,286
Transportation & Warehousing	$107,467.7	1,483	1,518	1,513	1,267	1,774
Retail Trade	$196,455.8	5,662	5,643	5,638	5,462	5,863
Information	$17,538.2	308	307	306	283	334
Finance & Insurance	$49,235.5	506	504	502	440	579
Real Estate & Rental & Leasing	$35,517.0	475	468	467	432	511
Professional, Scientific & Technical Srvs	$64,448.6	1,182	1,174	1,171	1,076	1,284
Management of Companies	$8,320.8	260	260	260	232	293
Administration and Waste Management	$27,652.4	340	341	341	311	375
Educational Services	$23,062.0	122	121	121	111	134
Health Care & Social Assistance	$260,673.7	2,240	2,217	2,211	2,013	2,466
Arts, Entertainment, and Recreation	$10,834.7	1,323	1,323	1,322	1,313	1,334
Accommodation & Food Services	$115,570.5	10,329	10,325	10,323	10,239	10,426
Other Services	$81,747.9	1,242	1,242	1,237	1,059	1,449
Government	$479,959.0	12,295	12,037	12,028	11,622	12,555
Totals	$2,073,752	$63,071	$62,423	$62,255	$56,544	$69,608
Percent of Total MNF 10-County Region	100.0%	3.0%	3.0%	3.0%	2.7%	3.4%

Although the projected increases in Forest-linked contributions from current jobs and income are substantial at the Forest level, they are fairly minor when compared to the overall MNF 10-County Region and State employment and income. Clearly there are other considerations—social needs, local industry, infrastructure maintenance, to name a few—that are having a far greater influence on local economies. Still, any potential additional contribution from Forest management activities would likely be welcome by local communities and counties.

Federal Payments to Counties

Table SO-33 shows the combined amount of 25 Percent Fund/Stabilized Payments in 2006 and PILT in 2005 for the counties within the Forest's region of influence.

Table SO-33. Forest-related 25 Percent Fund/Stabilized Payments (2006) and Payments in Lieu of Taxes (PILT) (2005) to Counties

County	25% Fund or Stabilized Payment	Payments in Lieu of Taxes	Totals
Barbour County	$8	$16	$24
Grant County	$43,156	$17,976	$61,132
Greenbrier County	$218,885	$154,197	$373,082
Nicholas County	$16,981	$36,144	$53,125
Pendleton County	$130,659	$76,625	$207,284
Pocahontas County	$666,828	$376,270	$1,043,098
Preston County	$8,460	$5,558	$14,018
Randolph County	$434,986	$290,565	$725,551
Tucker County	$214,388	$144,601	$358,989
Webster County	$142,318	$93,834	$236,152
Totals	**$1,876,669**	**$1,195,786**	**$3,072,455**

In addition to the funds shown in Table SO-33, counties would also receive a percentage of the Forest's oil and gas federal lease rents and royalties from the U.S. Treasury. Current revenue levels are not available. However, revenue levels from 1987 to 2003 averaged about $600,000 a year. Levels can fluctuate widely, depending on a number of factors, but have stayed within a range of around $280,000 to $1,160,000 on an annual basis.

Payments from all of theses sources go through the State of West Virginia for distribution to counties. As noted in the Direct and Indirect Effects section, these payments may not vary much by alternative, However, there are other factors that may cumulatively affect the amount of funds that counties receive from the federal government, including:

- Decisions by Congress involving the SRSCS Act and its funding,
- Decisions by the counties to choose 25 Percent Fund or Stabilized Payments (if available),
- State distribution of 25 Percent Fund/Stabilized Payments and PILT funds,
- Congressional changes to PILT funds authorization and appropriation,
- Additional lands acquired by the federal government within the Forest region counties,

- Funding from other federal land sources within the counties, such as the George Washington National Forest in Pendleton County, or the Canaan Valley National Wildlife Refuge in Tucker County.

It remains to be seen if counties will continue to have the option of receiving stabilized payments. If not, the amounts they receive would shift to 25 percent of the annual revenues generated by the Forest (and other federal land managers). Based on estimates from the IMPLAN model, these revenues could be much higher than they have been in the recent past. However, based on recent history, Forest revenues have fluctuated greatly, depending primarily on how much timber or natural gas is produced. Projected timber production would be highest in Alternative 4, followed closely by Alternatives 1, 2, and 2M, which have fairly similar production potential and then Alternative 3, which has considerably less potential (see *Timber Supply* section). The potential for leasing federal gas and oil is much the same, with Alternative 4 having the most land available for leasing, followed closely by Alternatives 2, 1, and 2M, and then Alternative 3 with the least amount of land available (see *Mineral Resources* section).

Forest revenues are also expected from recreation, livestock grazing, and special use fees. Recreation use is predicted to increase at a modest but steady rate under all alternatives, so revenues are expected to increase as well, though they are relatively small compared to average timber and gas revenues. Livestock grazing is predicted to remain roughly the same under all alternatives, but we cannot predict how the fees for grazing may change. Special uses cover a wide variety of activities, some of which are long term, and some of which are short term or temporary. These uses are not expected to vary measurably by alternative, and they have not been a major revenue producer in the past.

Additional sources of federal revenue that cumulatively affect the MNF 10-County Region come from cost-share agreements for road and fire management, and taxes paid by federal employees.

Economic and Financial Efficiency

Although there are many factors that could influence financial and economic efficiency on the Forest—including budget levels, timber values, recreational use patterns, and land management legislation—it is difficult to predict what changes might occur related to those factors. It is appropriate to assume, however, that any changes of a magnitude to be felt at the Forest-wide scale would likely affect all alternatives in a similar manner, and therefore would not differentially affect the way that Forest land managers would consider the alternatives in Forest Plan revision.

For the future short and long term, the Forest will continue to look at the economic and financial efficiency of implementing actions at the project level. Economic analyses are done on any project with significant capital investment as standard operating procedure.

Although the Forest Service is not a business, the agency has a limited amount of funding to work with on an annual basis, and the overall trend in funding for most resource programs recently has been flat or downward. Thus, the Forest has an added incentive to not only find economically and financially efficient ways of conducting its work, but also innovative ways of using funds from multiple program areas to generate benefits to a range of Forest resources, uses, and products.

Resource Commitments

This section contains effects disclosures that are required by federal law, regulation, or policy, and that generally apply to all the preceding resource area effects sections in this chapter.

UNAVOIDABLE ADVERSE EFFECTS

Forest Plan revision and Forest Plans do not produce unavoidable adverse effects because they do not directly implement any management activities that would result in such effects. The Forest Plans do, however, establish management emphasis and direction for implementation of activities that may occur on National Forest System lands in the planning period. If and when those activities occur, the application of Forest-wide and Management Prescription standards and guidelines would limit the extent and duration of any resulting environmental effects. However, some unavoidable effects could still occur. These potential effects are described by resource area throughout Chapter 3 of the EIS, primarily under Effects Common To All Alternatives.

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY

Short-term uses are those expected to occur for the planning period (10-15 years), including recreation use, timber harvest, and prescribed burning. Although these uses are not directly implemented by the Forest Plans, the potential for these uses are described in Forest Plan goals and objectives, both at the Forest-wide and Management Prescription levels (see Chapters II and III in the Forest Plan).

Long-term productivity refers to the capability of the land to provide resource outputs for a period of time beyond the planning period. Minimum management requirements, established by regulation (36 CFR 219.27), provide for maintenance of long-term productivity of the land. These management requirements would have to be met under any alternative. They ensure that the long-term productivity of the land is not impaired by short-term uses.

Monitoring and evaluation, as described in the 2006 Forest Plan (Chapter IV), apply to all alternatives. A primary purpose of monitoring is to ensure that long-term productivity of the land is maintained or improved. If monitoring and evaluation show that Forest Plan standards and guidelines are inadequate to protect long-term productivity of the land, then the Plan will be adjusted (through amendment or revision) to provide for more protection or fewer impacts during project implementation.

Although all alternatives are designed to maintain long-term productivity, there are differences among the alternatives in the long-term availability or condition of resources. There may also be differences among alternatives in long-term expenditures necessary to maintain or achieve desired conditions. The differences are discussed throughout the various sections of Chapter 3.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible and irretrievable commitments of resources are defined in Forest Service Handbook 1909.15, Environmental Policy and Procedures (9/21/92).

Irreversible commitments of resources are the consumption or destruction of nonrenewable resources, such as minerals or cultural resources, or the degradation of resources such as soil productivity, which can be renewed only over long periods of time.

Irretrievable commitments of resources are opportunities foregone; they represent tradeoffs in the use and management of Forest resources. Irretrievable commitments of resources include expenditure of funds, loss of production, or restrictions on resource use. When one alternative produces less of a natural resource (such as timber volume) or offers fewer opportunities for use (such as motorized recreation) than another alternative, the difference represents an irretrievable commitment of resources.

The decisions made in forest plan revision do not represent actual irreversible and irretrievable commitments of resources. This is because forest planning identifies what kinds and levels of activities are appropriate in different parts of the Forest; it does not make project decisions. The decision to irreversibly or irretrievably commit resources occurs at: (1) the time the Forest Service makes a project decision, such as approving a new trail or timber sale; (2) the time Congress acts on a recommendation to establish a new Wilderness or to include a stream segment in the Wild and Scenic River System; or (3) the time the Regional Forester designates a special area such as a Research Natural Area.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Energy is consumed in the administration of natural resources on the Forest. The main activities that consume energy are timber harvest, restoration activities including mechanical vegetation treatments and prescribed fire, recreation use, road construction and reconstruction, range use, and administrative activities of the Forest Service and other regulatory agencies. Energy consumption is expected to vary only slightly by alternative. Alternatives with higher potential for timber harvest and/or road construction, reconstruction and obliteration are expected to have somewhat higher levels of energy use. Based on that assumption, Alternative 4 would likely have the highest energy use, followed in descending order by Alternatives 1, 2, 2M, and 3.

Several opportunities exist under all alternatives to provide for energy conservation or conversion from less plentiful fuels to more plentiful fuels. For example, car-pooling and combining trips saves fuels and wear and tear on the Forest fleet. The use of electronic communication devices for sharing information rather than scheduling meetings at one location saves energy spent on travel. Improving energy efficiency of government buildings can conserve energy. More energy-efficient equipment for all activities like timber harvesting, road construction and reconstruction, or road maintenance can be required. More energy-efficient management methods can be explored and implemented as well.

PRIME FARMLAND, RANGELAND, AND FORESTLAND

Prime farmland, rangeland, or forestland have been identified on the Forest. Forest Plan revision does not implement any management activities that would directly affect these lands, although future implementation of the Plan could have effects. There are no specific federal restrictions on managing prime rangeland and forestland for their intended use, which is growing forage and timber, respectively. There are soil-related concerns with managing on prime farmlands, and the Forest therefore identifies proposed projects that would occur on prime farmlands and consults with the National Resources Conservation Service to ensure that unacceptable adverse effects do not occur.

EFFECTS ON THE HUMAN ENVIRONMENT

Effects on the human environment are documented throughout Chapter 3 of this EIS. Further documentation can be found in the project record. Effects related to Environmental Justice are found in the Social and Economic Environment section of Chapter 3.

THREATENED AND ENDANGERED SPECIES

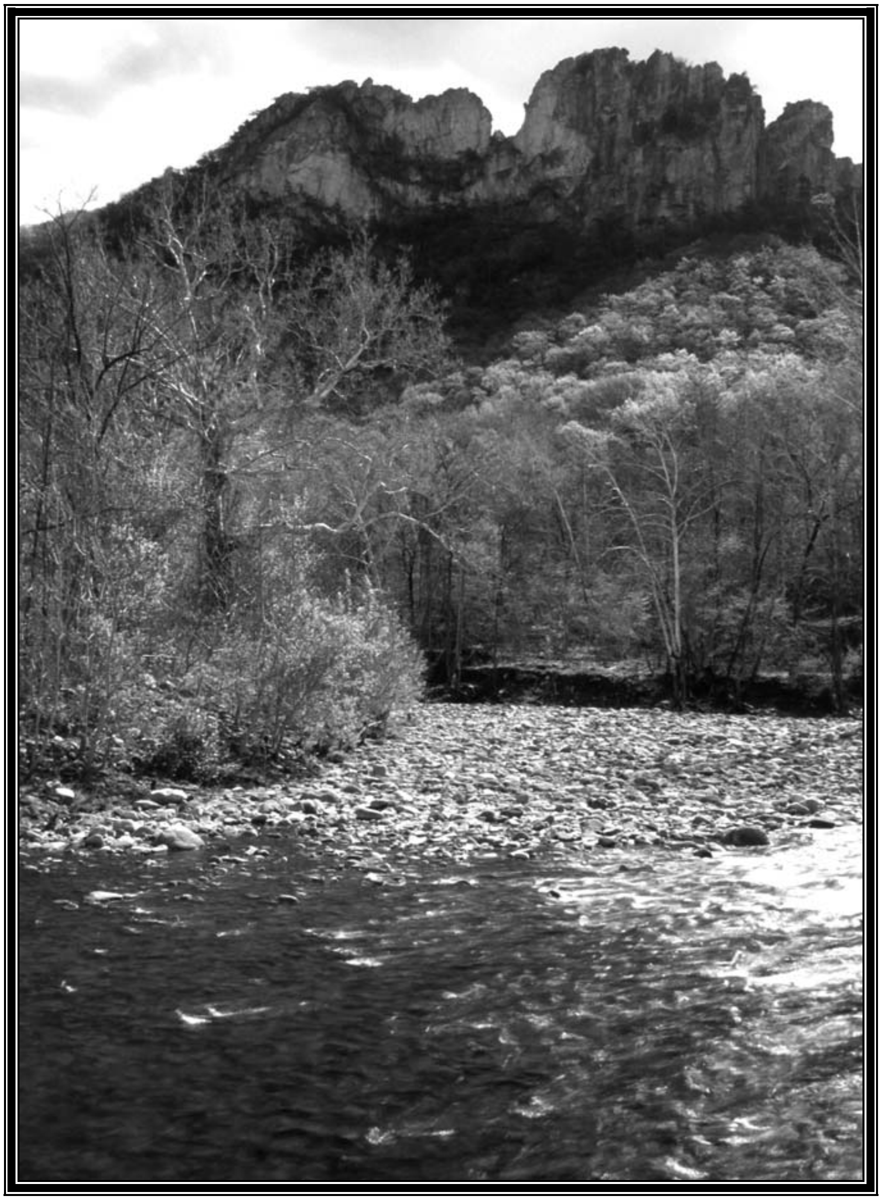
Potential effects to species listed under the Endangered Species Act can be found in Chapter 3 of this EIS (Threatened and Endangered Species section) and in the Biological Assessment that was completed for Forest Plan Revision. Management direction to protect these species, or to provide for their habitats, can be found primarily in Chapter II of the Forest Plan (Threatened and Endangered Species section).

WETLANDS AND FLOODPLAINS

There are numerous amounts of wetlands and floodplains spread throughout the planning area, with estimates of 6,000 miles of perennial and intermittent streams, their associated floodplains, 700 acres of reservoirs, and uncounted wetlands, seeps, and bogs. Forest Plan revision and the Forest Plan do not directly implement any management activities that would result in loss of wetland or floodplains. Revised Forest-wide management direction provides a broad spectrum of standards and guidelines designed to protect soil, water, riparian, and aquatic resources. The goals and intent of Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands) would be met through compliance with this direction.

CONFLICTS WITH OTHER AGENCY OR GOVERNMENT GOALS OR OBJECTIVES

Contact, review, and public involvement with other federal and state agencies has indicated no irresolvable conflicts between this Forest Plan revision effort and the goals and objectives of other governmental entities.



Seneca Creek and Seneca Rocks