



THE HIGHLANDS VOICE

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Mountain State OGBA Grows Organically

The organic growers certification program in West Virginia tells the who, what, where and how for all interested in naturally healthy products of the land. Various categories of membership create an organizational collective that represents the entire circle of participants: the grower, the buyer and the consumer. Application procedures for farm certification is based upon nationally recognized criteria for growing nutritionally safe foods in a manner consistent with land stewardship principles. Seller and consumer memberships are more easily obtainable.

The members of Mountain State Organic Growers and Buyers Association (MSOGBA) are as diverse as any group of West Virginians. Formed in April, 1989, the original founders numbered about twenty. Today there are over 100 members. By providing nationally recognized standards for certification, farmers and buyers believe they enhance the strengths of all members.

Certification is granted after a three person peer review committee evaluates the application, soil test results and report of an independent on-site investigation. The Committee's decision may be accepted, rejected or rejected with recommendations for future certification. A farm must be free from the application of chemical fertilizers for three consecutive years.

The organic grower must be committed to techniques that emphasize preventive measures and soil stewardship. What leaves the farm is always replaced. A healthy balance is to be maintained by focusing on soil fertility.

There is no single definitive definition of the organic farm. Guidelines applied all across the nation have established vital indicators that anchor organic practices. These include maintaining a minimum of 3.5% organic matter in the soil (the West Virginia standard); combining cover crops/green manure with animal fertilizer; never applying certain specified pesticides; and, reliance on biological methods of pest control.

Much like the modern pursuit of health for the body, preventive measures are applied and designed to eliminate problems before they occur. Growers also stand behind their products. Storage methods used to ensure delivery of healthy and nutritious produce do not rely on artificial chemicals or enhancers.

As a self-regulatory group, the successful organic grower possesses strong managerial skills. A developed management strategy for the farm is essential to the organic grower. MSOGBA members meet once a year. Plans for increased emphasis on educational activities will be undertaken as time and funds permit.

President Keith Dix envisions including standards for animals as national trends become established and more meaningful. Dix recalls his learning experience in organic techniques as a combination of trial and error and independent research. Now serving as WV University Visiting Associate Professor at The Center for Sustainable Agriculture, Dix is available for questions every Wednesday at 304/293-4801, or by writing him at Route 10, Box 30, Morgantown, WV 26505.

Pollution Pays

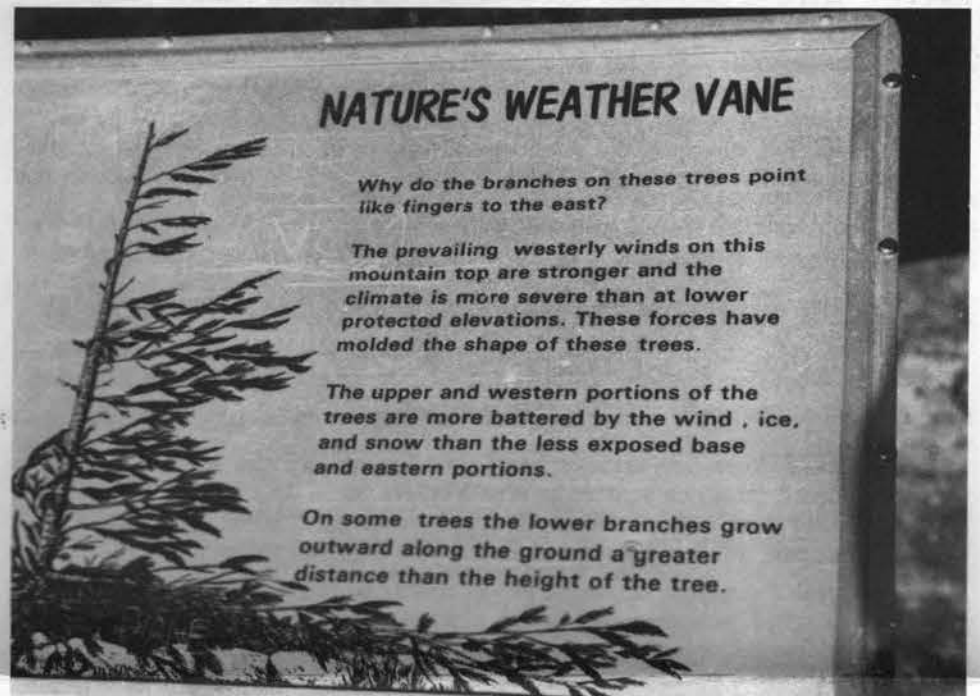
by Carroll Jett

Greetings to the West Virginia Highlands—from American Electric Power's Gavin Plant. Located directly across the Ohio River from Mason County, West Virginia, the Gavin Plant is the nation's number one emitter of sulphur-dioxide—the major contributor to the acid rain problem. In 1987, the last year for which statistics have been made available, Gavin dumped over 367 thousand tons of SO₂ into the atmosphere. Company wide, American Electric Power contributed 10.23% of all SO₂ emissions in the United States.

According to public records at the West Virginia Public Service Commission, AEP profits soared to an all-time record \$629 million.

For information on particular plants in your area, contact the Center for Clean Air Policy, 444 North Capitol Street Suite 526, Washington, D.C. 20001. Telephone 202-624-7709.

TONGUE IN CHECK DISCLAIMER: Although Gavin and other of AEP's "dirtiest" plants are located directly upwind of the streams in WV Highlands mentioned in Skip Johnson's article (see *Acidity Hits Record Highs on State Streams*), no implication is made or intended that AEP is in any way responsible for trout stream acidification in the WV Highlands.



This picture comes with its own caption. Spruce Knob, West Virginia 1990.

WVEC 2nd Annual Convention

The Second Annual West Virginia Environmental Council Convention is scheduled for September 7-9, 1990, at Jackson's Mill Conference Center. Organizer Norm Steenstra expects 300 to 400 delegates and 20-30 legislators.

Registration is now open. Write WVEC, 1324 Virginia Street, East, Charleston, West Virginia 25301 or call 346-5891. Ask for Shiela McEntee, Norm Steenstra or Missy Wolverton.

Application previews describing activities include defining Council role, developing an action agenda and establishing priorities. The concept of regional networks and specific issue committees will give structure to the working sessions.



American Electric Power's Gavin Plant smoke stacks are visible from a Mason County landfill. (Photograph taken July 7, 1990.)

—From the Heart of the Mountains—
by Cindy Rank

STUNNED

DNR Director Ed Hamrick did an amazing thing last month: . . . He said a trout stream is a trout stream. . . . More specifically, he said that Tenmile Creek of the Buckhannon River in Upshur County is a trout stream.

Sounds simple enough doesn't it? A mere statement of fact. Hardly cause for celebration or public acclaim. Hardly a sign of great personal courage or moral integrity.

And yet, Mr. Hamrick's predecessors the past 12 years have been unwilling or unable to make that statement despite supporting evidence in DNR files. NPDES permits for nearly 2,000 acres of mining were granted first to Island Creek Coal Company, then to Island Creek and the Italian Government under the name Enoxy, then to Island Creek Mining Company a subsidiary of Island Creek Coal, with discharge limits less stringent than those required to maintain the high quality of water originally found in Tenmile.

Of course it would be folly to suggest that stronger permit requirements would have prevented the devastation that has occurred at Tenmile this past decade. . . . In the late '70's the State, County and even some local residents bought into the coal industry's promised dreams of prosperity from what was billed as the Largest Surface Mine East of the Mississippi. But, mining in this sensitive and acid prone area was doomed from the start. The destruction began right away: acid water, as well as over and undertreated

(continued on page 3)

State Environmental Department's Time Is Now

by Frank Young

More than a dozen state agencies, boards and commissions now have responsibilities for environmental protection services in West Virginia. Some do a better job than others in implementing these responsibilities. All appear to be understaffed, with what staff is available underpaid, when compared with similar jobs in private industry.

These regulating entities are funded almost entirely by tax money appropriated by the legislature—a system now obviously flawed in terms of sufficient funding to perform the task of environmental protection adequately and without unreasonable political considerations and interference.

These various boards, agencies and commissions sometimes have promotional responsibilities at odds with environmental protection goals, as well as being overlapping and at odds with each other.

There can be a better way of regulating environmental protection. A separate, independent agency of government, known as the WV Department of Environmental Protection, or by some other similar name, should be established and charged with the sole responsibility of protecting the environment from the many demonstrated and potential abuses. Such an agency, for purposes of efficiency and adequate funding, might take on some of the characteristics of the State Tax Department and the Public Service Commission.

For example, the State Tax Department has responsibility for collecting virtually all the various kinds of taxes levied by state government. Indeed, it has strong powers to collect those taxes. Can you imagine the havoc and inefficiency which would result were the many various state agencies to have responsibility for collecting enough tax to fund their own budgets? Yet, that's the way environmental protection is handled—several agencies addressing many kinds of abuses, with little real enforcement powers.

Any person or entity doing business in West Virginia must register with the Tax Department. Likewise, any such entity should be required to register with and be subject to stringent environmental protection regulations by a Department of Environmental Protection. The standard for environmental protection regulations should be the use of **best available technology and prevention of further environmental degradation**. Like the tax department, the environmental protection department won't be liked by scalawags and scofflaws.

But, one might ask, wouldn't such a large and powerful agency be a further financial burden upon state government? The answer is no. Like the WV Public Service Commission, which receives all its funding from fees paid by utility companies, railroads, trucking companies and others it regulates, the WV EPA should operate on fees collected from those whom it regulates. What would be more fair than for those who need to be regulated to pay the cost of the regulation?

A fee schedule, based upon environmental risk factors, should be assessed of all regulated entities. A barber shop, or small grocery store, might pay a minimal regulatory fee, for example. A coal mine, a landfill or a chemical plant would certainly pay hefty fees based upon their likelihood of and potential for environmental damages and the degree of monitoring and policing required.

This system works well for the WV Public Service Commission, which effectively performs its charged duties within legally provided political bounds. Under this proposed environmental agency, funded by regulatory fees, the general state budget would realize some relief, as some of the general funds presently used by the various regulating boards, agencies and commissions would be available for other needs.

This writer believes that the only strong objection to a powerful, self-funded, effective Department of Environmental Protection will come from those who would continue to pillage, plunder and pollute with their putrid and poisonous pestilences in the unholy pursuit of personal and corporate profits with immunity from regulatory prevention and impunity from prosecution.

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CALL FOR PHOTOS

B & B Publishing, Fontana, Wisconsin 53125, is looking for color transparencies and black and white glossies that illustrate environmental issues.

A series for the school and library market will consist of fourteen 128 page books fully illustrated in color and black and white. Writing will be at the fifth and eighth grade reading level.

The first two subjects are recycling and global warming. Other topics will include transportation, vanishing rain forests, oil spills, acid rain, hazardous wastes, land use and abuse, urban sprawl, vanishing wetlands, water for people, fossil fuels, pesticides and herbicides, endangered species.

Include caption and preferred credit line. Budget is limited. Address questions to Kathleen Brooks Parker, 414-275-9474, FAX 414-275-9530.

Nations To Ban Ozone-Harming Compounds

Fifty-nine countries took an unprecedented environmental step last week by consenting to stop producing chemicals that destroy the Earth's protective ozone layer. The agreement requires the United States and other developed nations to set up a fund of at least \$160 million to help poorer countries in their shift toward less damaging chemicals.

The new measures significantly strengthen a 1987 treaty that required a 50 percent cut in production of only certain chlorine-containing chemicals — a reduction that would not successfully protect the ozone in Earth's stratosphere. The original agreement, called the Montreal Protocol, was weakened further when China and India declined to ratify it, saying the treaty did not provide sufficient assistance to developing countries in the form of money or technology.

With the establishment of the new fund, representatives of India and China said they would urge their nations to ratify the protocol as soon as possible. If both countries join, the fund will increase to provide developing nations with a total of \$240 million over the next three years, with the United States contributing \$60 million. Until two weeks ago, the Bush administration had opposed contributing to this type of assistance fund.

Settling the questions of technology transfer and establishing the fund proved the most difficult steps in reaching the agreement, says Richard J. Smith of the State Department, who represented the United States at preconference negotiations in London. Last week's discussions were much more complex than those leading to the Montreal Protocol, he adds.

The new agreement requires participating nations to end production of chlorofluorocarbons (CFCs) and halons by the end of the century, whereas the 1987 protocol called for a 50 percent cut in CFC production and a freeze on halon production by 2000. Today, CFCs have widespread industrial uses in refrigeration, air conditioning and the production of

foam and insulation. They also serve as solvents for cleaning electronic equipment and, in some countries, as propellants in aerosol cans. Halons are used in fire extinguishers.

Chlorine from such chemicals thins the stratospheric ozone layer, which filters out harmful ultraviolet radiation. CFCs and halons also contribute to global warming.

The revisions also regulate other important chlorine-containing solvents not mentioned in the 1987 protocol. Participating nations have agreed to lower production of methyl chloroform by 70 percent by the year 2000 and to end its production by the year 2005. They will also reduce carbon tetrachloride production by 85 percent by 1995 and stop producing it by the end of the century.

The agreement includes a nonbinding provision to phase out hydrochlorofluorocarbons (HCFCs) by 2040, and if feasible by 2020. HCFCs destroy ozone, although to a lesser extent than CFCs, and many companies have been developing these compounds as replacements for CFCs.

Thirteen nations pushed for a CFC phaseout before the year 2000. Although they failed to work that into the treaty, they committed themselves to a complete phaseout by 1997 at the latest.

Environmental groups and several nations view the revised protocol as a model for future negotiations addressing the more complex problems of global climate change. Many countries argue that the industrialized world is largely responsible for ozone loss and the threat of global warming, and therefore must help the developing world wean itself from polluting technology, notes S. Jacob Scherr of the Natural Resources Defense Council in Washington, D.C. Negotiators from the United States, however, inserted language into the new agreement stipulating that the ozone treaty does not set a precedent for solving other environmental problems.

—R. Monastersky

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Monongahela Guide

Edition 5 of the WVHC Monongahela National Forest Hiking Guide is now available. This edition is bigger and better than ever, with 320 pages, 60 maps, 39 photographs, descriptions of 164 trails totalling 780 miles, a new section on skitouring, and a full-color cover. The authors are Allen de Hart and Bruce Sundquist. Allen has hiked all the trails of the Monogahela N.F. over the past few years. Bruce edited Editions 1-4. The hiking community and the U.S. Forest Service provided the authors with trail reports and photographs.

Profits from the sale of these guides support a wide variety of worthy environmental projects in the West Virginia Highlands Conservancy.

To order your copy of Monogahela National Forest Hiking Guide, send \$9.95 plus 6% sales tax for WV residents, plus \$1.25 postage (book rate) to West Virginia Highlands Conservancy, P. O. Box 306, Charleston, WV 25321.

DOLLY SODS Wilderness and Scenic Area Plans

Dolly Sods Wilderness area includes 10,215 acres of Monongahela National Forest System land in Tucker County including Red Creek and tributaries. To the north and east of the Wilderness lies the Dolly Sods Scenic Area encompassing 2,470 acres.

The Potomac Ranger District is accepting public input on the management and use of these areas. Comments should be as specific as possible. Direct comments by September 30, 1990 to District Ranger, Potomac Ranger District, Route 3, Box 240, Petersburg, West Virginia 26847.

Don't let this opportunity to affect policy go by. State the values of this Wilderness area and offer suggestions that will enhance the qualities that make wilderness special.

(continued from page 2)

discharges began to impact both surface and ground water in the area. But political pressures allowed the operation to continue and to expand year after year.

On the other hand, insisting on more stringent effluent limits early on would not only have been more truthful but may have painted a clearer picture of the problems at an earlier point in time and may have weakened the political realities that made light of the destruction and allowed the problem to grow.

But there is really no use to second guess history and play the "What may have been if . . ." game. What does this all mean now?

It means that new permit limits will be imposed. It means that less iron and aluminum can be released from the operation. It means further manganese variances will be more difficult to come by. It will require additional treatment at the site. The Central Treatment System (CTS) will have to be upgraded, some secondary treatment system utilized to deal with the high levels of metals that are now present in the acid mine drainage that flows and seeps from the site. It means that the seeps and discharges that are not currently collected in the CTS will also have to be collected and treated.

Will all this help clean up the polluted ground water under and down dip of the mine sites and refuse slurry impoundments. Not really.

Will it bring back Tenmile? . . . Hopefully, at some time in the future once the treatment systems are in and operating well and consistently over a long period of time.

But there are more immediate and important effects of this action:

First, it will shift the cost of full and adequate treatment back to the coal company where it properly belongs. Currently use of Tenmile and the Buckhannon below Tenmile have been impaired for those who live along the banks. Also the City of Buckhannon now spends additional monies to treat the water to remove higher levels of metals that have been released by the mining upstream at Tenmile.

Second, more adequate treatment at the site should help to ensure the quality of the Buckhannon River which is needed to neutralize the Tygart River System that is used by residents of Philippi and Grafton and contributes to the quality of the Tygart Lake.

Third, correcting the errors of the past few years negates the unhealthy precedent that had been set. Destruction of a stream should not ever be rewarded by allowing higher levels of pollution.

And last but not least, this takes us one step closer to realizing what is the true and full cost of mining in these fragile and acid prone areas. No law, Federal or State, has ever intended that mining should be allowed to create long lasting acid mine drainage that will continue to destroy both surface and ground water supplies for years after the mining is finished. But despite the reasonableness of this assumption, the cold hard facts of economics seem to be heard more readily. With the State spending nearly \$1/2 Million each year for treatment at the old DLM site just upstream, and the possibility of inheriting the larger Tenmile Site where treatment costs prior to the Central Treatment System were \$3,000/Day and still inadequate (I don't know the current annual cost though it is still not the full cost of proper or complete treatment), we can only hope that future permits at this and similar sites will be denied as well they should be.

And so, although on the surface Director Hamrick's statement was a rather simple statement of fact, the ramifications of that pronouncement are important and far reaching.

It was a bold step. —One that will surely be appealed by Island Creek Coal and Mining Companies. And one that will surely be attacked behind the scenes by the people and pressures that have promoted the travesty of Tenmile these past 12 years.

Mr. Hamrick deserves strong and vocal support.



SCHOLARSHIPS AVAILABLE

for
1990 Annual Conference on the Environment
October 25th and 26th
Charleston Civic Center

LAND USE AND THE ENVIRONMENT

The sixth annual Conference on the Environment is sponsored by the West Virginia Environmental Institute, a broad based group of industry and environmental organizations working together to foster improved communication on issues of mutual concern.

Mary Wimmer, Conservation Chair of the W. Va. Sierra Club and Chair of this year's conference promises a thorough, in-depth look at the many aspects of land use planning:

- What it is. What it can be.
- How West Virginia was, is, and could better utilize land planning.
- What environmental impacts entail.

To be included for a Highlands Conservancy scholarship contact:

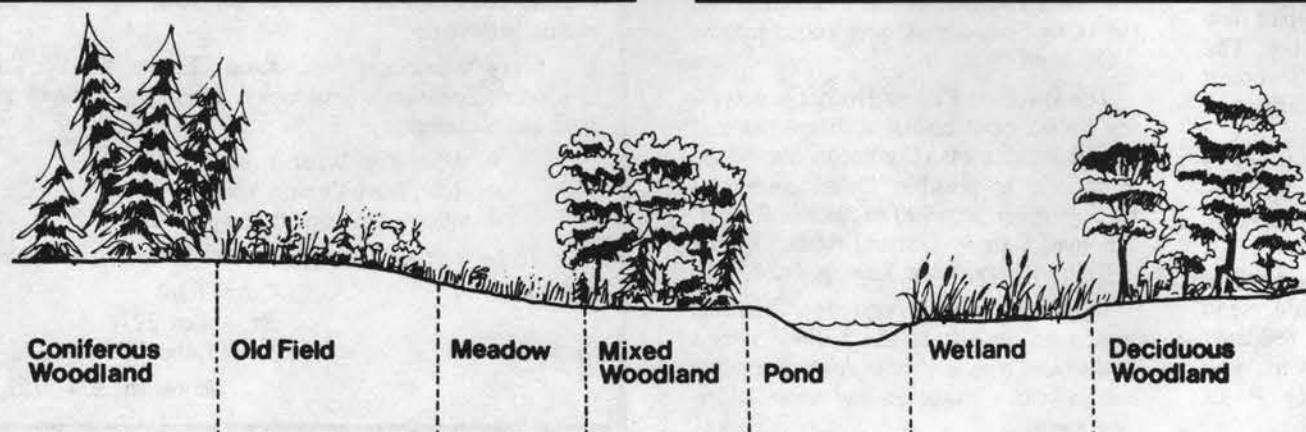
Cindy Rank
Rt. 1, Box 227
Rock Cave, WV 26234

phone: (h) 924-5802, (w) 924-6263

Modern Summary of Land Planning for Biodiversity

- (1) Encourage a holistic, ecosystem approach to environmental planning.
- (2) Consult biologists, ecologists and landscape architects at every stage of planning and development during operation, management and maintenance phases.
- (3) Conduct wildlife inventories, plant inventories, gather relevant information about wildlife and use patterns.
- (4) Join with adjacent land owners and other area neighbors to ensure protection of a diverse habitat by cooperation.
- (5) Retention of a suitable habitat is the primary consideration for managing and enhancing plant and animal species.
- (6) Treat topsoil with the care it deserves as a valuable resource. Wildlife is dependent upon soil fertility just as cultivated crops.
- (7) Make every effort to minimize soil erosion on disturbed sites. Revegetate quickly.
- (8) Establish native plant species as soon as possible to ensure permanency and low upkeep.
- (9) Select plants for erosion control. Understand a plants value to wildlife and to the soil.
- (10) Protect watershed integrity. Provide for water quality standards for surface and ground water. Account for cumulative and immediate effects.
- (11) On construction sites, save all possible trees, shrubs, and ground cover. For wildlife, trees need not be perfect specimens. Dead trees may be more valuable than living trees for some species.
- (12) Multilayered vegetation with a diversity of species is more suitable and attracts more wildlife species than monoculture or tall tree and grass combinations.
- (13) Select a mixture of species native to the area or chosen with help of wildlife biologists, horticulturists, and landscape architects when selecting trees and shrubs or other plants for landscaping or replacement purposes. Choose species well suited to the environment with aesthetic value and value to wildlife.
- (14) Take advantage of opportunities for improving land presented in water management, flood control programs, and abandoned mine lands programs.
- (15) Encourage diversity by developing lakes and ponds wherever possible.
- (16) Use natural drainage systems as much as possible. Natural channels can accommodate more storm runoff than can artificial channels.
- (17) The unnecessary channelization or alteration of stream courses and the drainage of wetland areas should be avoided.
- (18) Minimize the effects of pollution.
- (19) Evaluate the effects of existing discharge standards on streams and lakes in the effected watersheds and encourage standards adequate to prevent pollution and the overenrichment of bodies of water.
- (20) Evaluate clean air standards for the area. Identify sources of pollution and types of pollutants and the effect on the environment.
- (21) Encourage adoption of ordinances, zoning or other regulations to minimize pollution and overenrichment of lakes.
- (22) Use green spaces to control pollution by direct action of the plants and to cool the ambient temperature.
- (23) Design with conscious knowledge of the microclimate. This includes exposure conditions, windshear, topography and all site variables.
- (24) Avoid creating habitats such as dense pine plantations, that are likely to be used as roosts by large numbers of blackbirds and starlings.
- (25) Require progressive rehabilitation of sand, limestone, clay, gravel, and all other mining sites.
- (26) Enforce ordinances that prohibit free-roaming dogs. Consider better control of cats. Either can be destructive.
- (27) The design and construction of buildings have great effect on bird populations. Be cautious of reflective glass in wooded areas, the tree reflexion may confuse a bird.
- (28) Poor construction resulting in nooks and crannies may result in uninvited nesting birds.
- (29) Meet basic needs of wildlife.
- (30) Consider areas adjacent to the site as well as the site itself to maximize wildlife amenities.
- (31) Determine the effects of development on any threatened or endangered species.
- (32) Retain in as natural condition as possible the land from topsoil, surface drainage and ground water systems.
- (33) Floodplains may be effectively used for recreation or agriculture, not development.
- (34) Connect parks, woodlands, ponds, marshes with continuous vegetated corridors.
- (35) Allow for natural succession where possible.
- (36) Design and construct roads to have the least impact on wildlife.
- (37) Use biological control measures for pest control.
- (38) Take formal steps to ensure continuous protection by using available registration and certification procedures and by posting.
- (39) Provide access that minimizes conflict between man and other inhabitants of the area.
- (40) Protect wildlife and plant life as a living resource. Apply and maintain sound environmental practices.

from "Planning for Wildlife in Cities and Suburbs"; Biological Services Program, January 1978, and other sources.



To Sharon Fairley (a schoolgirl in Seattle, Washington)
November 6, 1954

Dear Sharon:

A person's experience on a mountainside turns so much on his own personality. For myself it is a testing ground of my strength and endurance, a putting of finite man against one of the great rigors of the universe. It is an interesting testing ground. A man—or girl—can get to know himself—or herself—on the mountain. He gets to know his inner strength—the power of the soul to add to the power of the legs and lungs.

In the solitude of the mountains—especially on the highest peaks—he is close to the Heavens, close to the outer limits of the earthly zone. It is for me easy, therefore, to have communion with God and to come on understanding terms with my own being. Other people may have different experiences. These are the essence of mine.

★★★★★

To Jean-Paul Harroy (Vice-governor general of Uranda, now Burundi)
May 5, 1960

Dear Governor Harroy:

I have recently heard of your plans to preserve the mountain gorilla in Albert Park. I congratulate you on your fine conservation program. We Americans sometimes get the reputation of people who want animals around merely to hunt and shoot. But there are millions of us who also love the life of the forests and plains for what it is and who try to keep civilization from crowding it out of existence.

I often think how awful it would be if as a result of our practice of extermination we ended up with nothing but people on this earth.

★★★★★

To Editor, Yakima Daily Republic
July 28, 1965

Dear Sir:

Your issue of July 21 contains editorial comment which contains a misconception both of multiple use and of wilderness values. A piece of land paved for highway use is dedicated to one single use, not multiple uses. An impoundment of water may serve irrigation needs, hydroelectric power, flood control, and boating and fishing. It preempts all other uses. An area set aside as wilderness does not "bar" trails as your editorial states, although it does bar roads. Wilderness use covers a variety of multiple uses—refuges for elk and goats, hiking and horseback travel, fishing, watershed protection, and the maintenance of the biotic community in complete ecological balance. These values cannot be preserved if logging, highways, hot dog stands, and motels take over.

Wilderness has the special values I have mentioned; and it also has spiritual values as well. Wherever cars go, crowds now go. Campgrounds for those who travel by cars and trailers are needed in increasing quantities. Wooded areas can be logged and campgrounds for autoists can be built on those sites, those tracts serving these two uses to preempt every section of land. We want some of the original America left in primitive condition so that one hundred years from now a lad can walk the North Cascades in the manner of Daniel Boone and see what God has wrought.

Your editorial assumes that the values of our mountains are dollar values. There are those values to be exploited. But a tree is measurable not only by its board feet or its cellulose content, but by its beauty, the wildlife it shelters, the biotic community it nourishes, and the watershed protection it gives.

There are spiritual values in the mountains that highway engineers, real estate promoters, chambers of commerce, and editorial writers often overlook. The Psalmist said, "I will lift up mine eyes unto the hills from whence cometh my help. My help cometh from the Lord who made heaven and earth."

Those values disappear once Blankenship Meadows are converted into a Swiss alpine resort area, when the roar of traffic fills the ridges, when man's last refuge (except the ocean) is converted to commercial uses.

Your editorial to the contrary notwithstanding, multiple use means more than logging trucks and highways and the exploitation of dollar values.

from THE DOUGLAS LETTERS, edited by Melvin I. Urofsky

Butterfly Gardening

by Tom Allen, DNR Biologist



Butterflies can be a welcome addition to your home and surroundings. Not only do their bright colors add excitement to our lives, but they are also effective crop and flower pollinators, play an important role in the food chain, and are sensitive indicators of environmental quality. Weeds and wildflowers are all it really takes to produce a butterfly garden. However, to attract the greatest number and variety of these beautiful creatures, plants that serve all the life stages of butterflies must be provided.

All of the approximately 760 different butterflies in the U. S. and Canada follow the same general life cycle. The cycle begins with eggs, laid in spring, summer or fall. Once hatched the tiny larvae (or caterpillars) molt 4 to 5 times, before enveloping themselves in a cocoon or chrysalis. In this pupal stage the caterpillar undergoes metamorphosis and emerges as an adult butterfly. The entire process takes an average of 5 to 6 weeks. Some butterflies go through only one cycle or generation each year. Some, however, may have 2 and even 3 generations in a single season.

The butterfly's life cycle requires food for both the larval and adult stages. Often the food for the larval stage is the most critical. Thus, many butterflies lay their eggs on or near the plants upon which the larvae feed. Most caterpillars eat the leafy parts of their host plants, but, depending on the species, may prefer flowers, weeds, vines, shrubs or trees. For specific examples, see Table I.

Unlike the finicky caterpillars, adult butterflies may take nectar from many different plants. Nectar is sipped through a long, straw-like proboscis that is normally kept coiled. The insects' feet possess a special sensing structure which can detect or "taste" sweet liquids, causing the proboscis to uncoil when in contact with nectar.

Butterflies frequent wildflowers as well as cultivated annuals and perennials. The three most important floral characteristics that attract butterflies to a flower are a copious supply of nectar, a blossom with large petals so that the insect can perch while feeding, and flower color. Butterflies seem to investigate purple flowers first, then yellow, pink and finally white. Table II includes only a sampling of the many blossoming plants attractive to adults.

Although their most popular food source is nectar, not all adult butterflies are nectar feeders. Some prefer to "puddle." Puddling is usually done by newly emergent males which gather to take moisture and minerals from damp sand, mud puddles or stream banks. Often a garden pool will attract butterflies to the water's edge. A number of species will also seek nourishment from the moisture in animal waste or carrion.

In order to encourage butterflies to your backyard, there are several facets with which you need to be familiar. First, learn the names of the local butterflies, their life cycles, food preferences, the places they hibernate, seek cover and pupate, and identify the plants suitable for egg laying. This all can be accomplished through the use of field guides, such as *The Audubon Society Field Guide to North American Butterflies* by Robert Pyle or *Butterflies East of the Great Plains* by Paul Opler and George Krizek.

Once you have established which butterflies you want to attract and the plants that will entice them, gather and sow the desired plant seeds ensuring the proper growing conditions for each plant type. Sun and shade relationships should be assessed, as well as plant groupings. Even with limited space you can still create a world for butterflies. Many

preferred food plants make attractive borders, can be planted in cool shady spots (such as violets) or, as in the case of vines, be trained to archways and fences, thus expanding your garden upward. Certain desired butterfly species may not appear the first year. The success of your garden requires constant patience and evaluation.

If the area you select is already a natural area, few alterations may be required. Open places such as meadows are subject to natural succession and may need to be mowed periodically to keep out brush. Only a section should be mowed in any one year so as not to upset the established life cycles of butterflies in unmowed sections. Situating your butterfly garden near a woodland may also attract more species.

Several potions may be used to attract butterflies and moths. One favorite can be made as follows: 1 bottle of beer spiked with banana, several tablespoons of brown sugar and molasses, 1/2 cup of raisins and several apple slices. Homogenize the mixture in a blender and store it in a loosely capped bottle for several days. Once the mixture has fermented it is ready for use. For moths, liberally brush on tree trunks. To attract butterflies, soak a sponge in a bowl and place it in broken sunlight or open shade. A slight breeze will broadcast the aroma.

There is no secret formula—but the more time you spend butterfly gardening and the more willing you are to experiment, the more accurately you will be able to assess your butterflies' needs. Butterfly gardening can be a new and enjoyable pastime—as well as enhancing your surroundings and the quality of your environment.

A survey of WV butterflies was conducted in 1984 in conjunction with the Nongame Wildlife Program of the WV DNR. Efforts were concentrated on determining distribution and abundance of uncommon butterfly species found within the State.

One hundred and nineteen species of butterflies, including 39 kinds of skippers, have been documented to occur in WV at the present time. Assistance is needed in developing a more complete listing of butterfly species and their distribution in WV. Persons interested in assisting this project as cooperators may obtain current information, maps, and a checklist on butterfly species from Tom Allen, WV DNR, P. O. Box 67, Elkins, WV 26241.

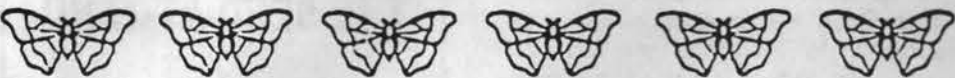


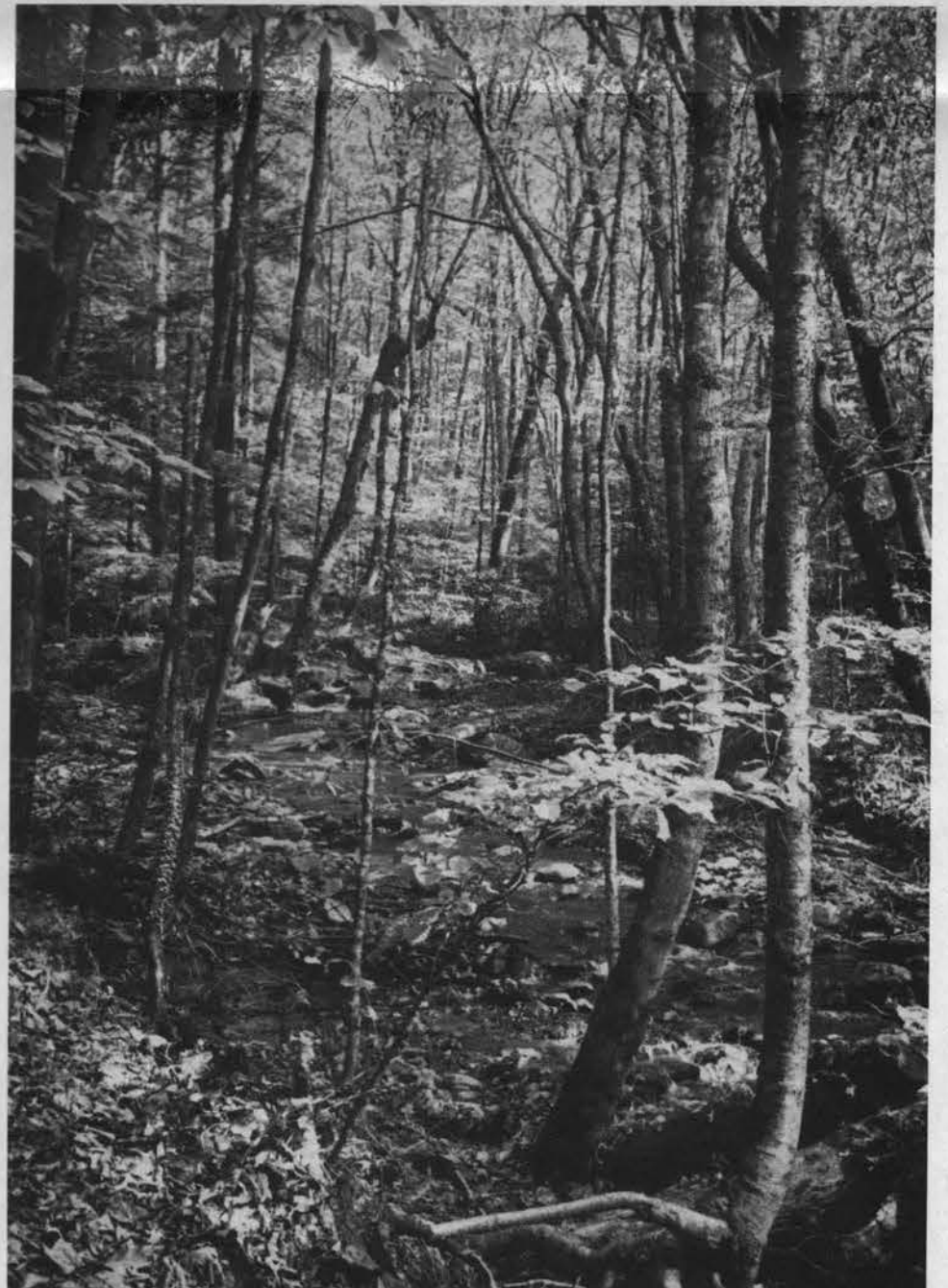
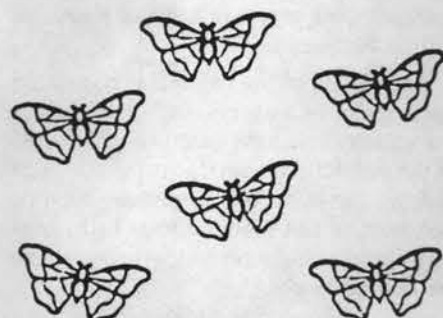
Table I. Larval Food Plants

Plant	Butterfly Species Attracted
Clover family	blues, sulphurs
Dock	coppers
Elm	mourning cloak, question mark
Grasses	satyrs
Hackberry	hackberry, tawny emperor, snout nosed
Hawthorn	gray hairstreak
Mallow family (cheeseweed)	common hairstreak, checkered skipper
Milkweed	monarch
Nettle	tortoise shell, painted lady, question mark, red admiral, hop merchant (or comma), veined white
Parsley family	black swallowtail
Plantain	buckeye
Poplar	mourning cloak, viceroy, redspotted purple
Sorrel	American copper
Spicebush	spicebush swallowtail
Thistle	painted lady
Turtlehead	baltimore
Violet	aphrodite, great-spangled, tritillary
Wild cherry	eastern tiger swallowtail, coral hairstreak, red-spotted purple
Willow	comma, tortoise shell, viceroy, red-spotted purple

Table II. Nectar Plants

Cultivated Annuals	Cultivated Perennials	Wild Perennials
Alyssum	Anthemis	Boneset
Candytuft	Arabis	Dandelion
Cosmos	Aubrieta	Goldenrod
Gaillardia	Buddleia	Joe-pye-weed
Marigold	Butterfly weed	Milkweed
Mignonette	Daisy	New England aster
Scabiosa	Catmint (Catnip)	Thistle
Verbena	Phlox	Wild bergamot
Zinnia	Primrose	Yarrow

(Tables adapted from "Butterflies are Free," by Maryanne Newsom-Brighton, National Wildlife, April-May 1982).



Pictured is a native West Virginia trout stream. Every stream should be able to support trout and the life they need to be a viable species in their native habitat. See Cindy Rink's editorial STUNNED.

"Today, Americans live in a country where food production is supposed to be the world's most efficient. Yet food prices have continued to rise. The cliché holds that back in 1900 one U. S. farmer could feed only five people besides himself and that today he can feed thirty. But Michigan University food scientist George Borgstrom says these mathematics are illusory. At the turn of the century farmers, in addition to working their land and raising livestock, delivered their own milk, butchered their own animals, churned fresh farm butter, salted meat, baked bread, and farmed with draft animals for which they produced feed. Now these draft requirements are fulfilled by expensive machinery using increasingly costly and depletable fossil fuels, and the husbandman's arts have been taken over by factories. In less than twenty-five years several million poultry raisers whose chickens roamed the land ingesting all sorts of material vegetable and mineral products as well as insects, have disappeared, to be replaced by some six thousand semiautomated outlets where broilers, packed wing to wing in cages, are fed diets full of artificial supplements.

All these off-farm activities figure in the high cost and dubious quality of food. In fact, if one divides the twenty-two million workers building farm machinery and farm-to-market roads, delivering and processing farm produce and engaged in other food-production tasks, it becomes clear that it takes about the same number of people to feed Americans today as it did in 1900."

The Secret Life of Plants, by Peter Tompkins

Organic Farms Sponsor Walking Workshop

The Earth Tenders Walking Workshop held Saturday, July 14, 1990, was an opportunity for the public to explore some of West Virginia's organic farms. Easily accessible from Interstate 79, four farms in Lewis County made up the tour. All are members of MSOGBA, Mountain State Organic Growers and Buyers Association. The Mountain State OGBA creed states: "By caring for the land and viewing the soil as something to be protected and nurtured, organic farmers help ensure that the land will continue to produce healthy food for future generations. By growing green manure crops and by adding animal manures, composted residues, and natural soil minerals, organic farmers replenish the nutrients removed by plants and animals that leave the farm. Healthy, fertile soils, crop rotation and the use of adapted, pest and disease resistant varieties yield plants and animals that need less human intervention in terms of pest control. Biological techniques, including the introduction of predatory insects and spraying with plant-based liquids, are only used if pests or disease become a serious problem."

Along with developing and refining techniques used in organic growing—composting, biological insect control, companion planting—Mountain State OGBA formulates standards for the end product of their labors too. Organically grown fruits, vegetables and herbs will be more easily identified. The organic certification will have meaning. Consumers will be assured that the ideals of the creed have been put to practice. No chemical fertilizers or pesticides will have been applied.

Initial standards now in place provide guidelines for farmers/gardeners. Converting from the practices of chemical fertilization and monoculture planting to an organic farm is a three year procedure. This ensures the soil conditions are healthy. Potentially unlimited in size, an organic grower must keep a balance between what grows out of the soil and what is placed back into the soil.

The root zone area receives particular attention. The organic grower relies on ancient techniques of crop rotation as well as up-to-the-minute methods for weed control. Successful companion planting enhances both plants at the root level—the channel into the earth—as well as the area we see. Protection and nurturing of the soil is as much a product of each growing season as vegetables, fruits or herbs.

The Walking Workshop allowed nearby growers to exchange information, inspire novice growers and gave the curious an opportunity to explore. Practical tips abounded and evidence of their effectiveness was everywhere.

An organic grower for twenty years, Myra Bonhage-Hale of La Paix Farm places particular emphasis on herbs. Flowers especially suitable for drying, vegetables and select experiments with green vegetables popular with 'yuppies' completes her garden.

A small solar dome, readily purchased from Garden Wall and other mail order suppliers serves as the greenhouse for seedlings, making La Paix self-sufficient. The cold frame at La Paix extends growing well into October. Simple, inexpensive and effective, it is placed with a southern

exposure. Baled straw forms the rectangular frame. Old windows and doors with glass panes intact complete the enclosure protecting the plants from the elements while providing sunlight. Plastic may be layered over the windows in extremely cold weather.

Raised beds in the main garden, layed out in the form of a peace sign emphasizes the importance of the soil as the basis for growing. Companion planting at La Paix includes beans with corn and basil with tomatoes. Garlic is an excellent companion for almost any plant. Eggplants covered with ramay cloth looked like giant spider webs generated by the latest software graphics package. Approximately two feet wide, the cloth protects the plant from insects and allows free exchange with sun, rain and air. Plastic mulches may also be used to protect areas before planting by preventing weed growth and warming the soil.

Encouraging birds in winter—feed them in the summertime—and resident bats help eliminate the insect population at La Paix. Bats have increased in popularity with organic growers because of their appetite for insects. Ms. Bonhage-Hale recommends *THE NEW ORGANIC GARDNER* by Eliot Coleman as a complete reference guide. The book gives explanations of the latest techniques and practical advice.

Arriving in West Virginia in 1975, Dot and Bob Montgillion of Smoke Camp Crafts concentrated on medicinal herb collection, cultivation and preparation and exploration of native plant species. Always available to area colleges, these botanists continue to share their knowledge with students in the classroom and on their farm. Blooming trees, plants and flowers appear all around the house and in nearby plots and groves—every one lovingly monitored and nurtured.

In addition to medicinal herbs, Smoke Camp Crafts also produces a variety of culinary herbs. The drying room and shop area display dozens of jars and packages of herbs, dried flowers and rows of jellies. A poster from one of the first herbalist conventions completes this entrepreneur's shop.

Sensitivity to the life cycle of the plant is evident in their organic farming techniques. Several raised herb beds are bordered by white pine trees. Shed needles cover the earth surrounding the plants and help control weeds. Smoke Camp supports establishing reliable and meaningful standards for consumers. Their commitment to organic methods is absolute. Organic techniques applied at Smoke Camp include composting and cross-fertilization. The chicken house serves as a major source of natural fertilizer.

Knowledge of the individual plant's life cycle ensures success and encourages evaluation of success based on the merits of the natural process of growth. The skull cap, used in stress related disease, must be harvested in full bloom. Other herbs may be snipped at indiscriminately and produce the desired results.

Time didn't allow for a visit to Harmony Hill and Top o' the Morning Farm, the other two farms on the tour schedule. The opportunity to see results of farmers committed to the Mountain State

"... But August is more than a flower garden. There is a ripeness that begins to mark the land, a fore-runner of the autumn harvest, a reminder that harvest is not a quick end-of-season achievement. It begins with the first cutting of hay in June and continues until the corn is all gathered, perhaps in November. It begins with radishes and lettuce and peas in the garden and doesn't end until the winter squashes are gathered.

August ripeness can be seen in trees. In old fields the staghorn sumac (*Rhus typhina*) is now in fruit, with a color thoroughly tropical, a deep crimson cluster of berries. The American Indians made a pleasant 'sumac-ade' by pounding them in water; they liked it so well that they gathered large quantities of the fruits when they were in their prime and dried them for winter use ..."

from *THE WONDROUS YEAR WEST VIRGINIA THROUGH THE SEASONS*, by Earl L. Core

OGBA creed was a valuable one that should be repeated in the future. The future for these organic farmers is a real variable that is prominently factored into plans for the plantings of 1989 and the harvest of 1990.

In fact, it might be more accurate to characterize the future as the only constant in the organic farmers' plans. Constant evaluation of techniques and methods results in revisions and changes in accepted organic practices as they are applied in the field. Individual farmers' commitment to sustainable practices to ensure healthy and fertile soil for the future is a given constantly applied.

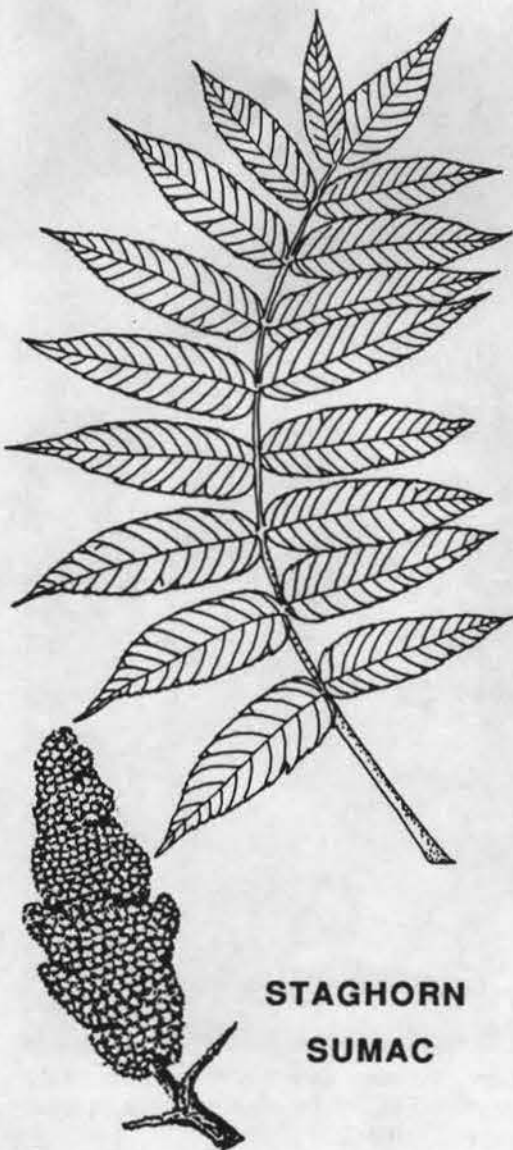
THE SEED-AT-ZERO

The seed-at-zero shall not storm
That town of ghosts, the trodden
womb
With her rampart to his tapping,
No god-in-hero tumble down
Like a tower on the town
Dumbly and divinely stumbling
Over the manwaging line.

The seed-at-zero shall not storm
That town of ghosts, the manwaged
womb
With her rampart to his tapping,
No god-in-hero tumble down
Like a tower on the town
Dumbly and divinely leaping
Over the warbearing line.

Through the rampart of the sky
Shall the star-flanked seed be
riddled,
Manna for the rumbling ground,
Quickening for the riddled sea;
Settled on a virgin stronghold
He shall grapple with the guard
And the keeper of the key.

—Dylan Thomas



STAGHORN
SUMAC

Volunteers Pay to Help Scientists Conducting Ecological Research

by Nancy Sterngold

Naivasha, Kenya—As a small boat crowded with researchers, instruments and canisters of water etched radiating circles on the glassy surface of Lake Naivasha, and fish eagles swooped from the trees, a voice sang out from on board "Temperature, 22. Oxygen, 5.7."

The readings were from instruments that had been lowered into the lake as part of a study of its ecosystem led by Dr. David Harper of the University of Leicester in England. On past projects he used students, but for this study he turned to 11 untrained volunteers, who spent two weeks measuring the amount of sunlight penetrating the water, dissecting fish, counting rooted plants, watching what the eagles ate and dutifully recording data.

The volunteers, who paid their own way, are among thousands who sign up each year to help scientists with research at far-flung sites—observing orangutan behavior in Borneo and musk oxen in Alaska, studying Lake Baikal in Siberia and counting lobsters in Key West, Fla. Archeologists have traditionally turned to volunteers, and now ecologists, field biologists and anthropologists are increasingly calling on their help, too.

"We've been called a populist reincarnation of the 19th-century tradition of amateurs in science," said Blue Magruder, director of public affairs for Earthwatch, which sponsored the Lake Naivasha study and is the largest of a handful of groups that bring scientists and amateur helpers together. "We provide an opportunity for people to become mini-supporters of research," he said.

Rick North, a fisheries scientist with the National Rivers Authority in England who participated in the study, said: "Collecting the information involves a lot of manual work. The volunteers extend the data collection system. Nearly all the work that needs to be done can be done by sensible people who can clean out fish nets and collect water samples."

At least one study has shown that untrained volunteers are able to produce reliable data. Dr. Charles van Ripes, a research scientist with the National Park Service and professor of biology at Northern Arizona University, compared the results of a volunteer team making field observations with the numbers trained technicians came back with. He discovered that while individual volunteers might be off by 12 percent or 13 percent, their results departed from the technicians' by just one-half of 1 percent.

Dr. William Herrnkind, a professor of biology at Florida State University who has used Earthwatch volunteers in his studies of Florida's spiny lobster, said: "The one thing we could not do without was manpower. So much of field work involves repetitive chores. But there is always this continuous new discovery of things by the volunteers, and it keeps the atmosphere from becoming drudgery."

A scientist's drudgery can be a volunteer's delight. Two weeks after she returned from Lake Naivasha, Deanna Wagorski signed up for an Earthwatch project, classifying plant communities and the animals that use them in Golden Gate National Park, that was within commuting distance of her home in the San Francisco area.

Eugene T. Rowe, a veteran of 15 Earthwatch expeditions, said: "I had so much fun doing this so-called work. It's an incredible learning experience."

Earthwatch projects are screened and selected by the Center for Field Research. The center reviews proposals to determine the scientific merit of the work, and the credentials and publishing history of the researchers are evaluated as well. Some projects have co-sponsors like the National Science Foundation and the Fulbright Foundation.

FOREIGN SPECIES INTRODUCED

Another organization, the University Research Expedition Program, a unit of the University of California, sponsors projects from scientists and researchers of the university.

In the research here, Dr. Harper has been studying the ecology of a lake that has been much changed by human intervention; his goal is to provide a solid data base for managing the lake more wisely.

Six thousand feet up in the African highlands, Lake Naivasha is a colorful wildlife habitat supporting hundreds of species of birds, 230 hippopotamuses and troops of colobus monkeys. Near the lake thousands of Kenyans farm, raise dairy cattle and prosper on the tourist industry.

In the last century, the basin dried up. When rainfall and river flow replenished it, the lake was restocked with fish: the wide-mouthed bass was brought from America by Theodore Roosevelt; two east African fish, Tilapia zillii and Oreochromis leucosticta, were added for local consumption. A commercial fishery thrived but was later threatened when the Louisiana crayfish was introduced to give the seafood menu more variety in the 1970's.

The omnivorous crayfish devastated the food chain by eating nearly everything in sight. In 1983 the commercial fish catch was more than 100 tons per year; in 1984, it plummeted to 6 tons.

In the 1960's, an ornamental South American water fern, *Salvinia molesta*, came to the lake by unknown means. It grew so fast that it overwhelmed indigenous plants, including the water lily, which is home to the lily trotter, a long-legged water bird that nearly disappeared from the lake. The *Salvinia* has grown into a large, thick, traveling meadow pushed around the lake by the wind.

"The actions that were taken introducing species were made with good intention but insufficient information," Mr. North said. "If they'd known what would happen, they probably wouldn't have done it. It isn't a managed lake, it's an interfered-with lake."

To get a snapshot of Naivasha's turbulent life, Dr. Harper, Mr. North and their teams of volunteers have surveyed a variety of related factors. The keystone of the food chain is photosynthesis, and the actual amount occurring in the lake is determined by measuring factors like chlorophyll in algae samples, nutrients in the water and the amount of light penetrating the water. Observing that the fish eagles and large water birds were changing their diets, Dr. Harper has begun a more formal study of the adaptation of these species to a changing environment. Mr. North has been monitoring the slow resurgence of the fish population since overpredation by the crayfish abated.

HOW TO JOIN A RESEARCH TEAM

Earthwatch. This year Earthwatch is sponsoring 199 projects. Scholarships and grants to secondary school teachers and students are available. Membership is \$25 a year. Write 680 Mount Auburn Street, Box 403, Watertown, Mass. 02272 or phone (617) 926-8200.

Archeological Institute of America. The Archeological Fieldwork Opportunities Bulletin is published every January at \$10.50 for members, \$12.50 for non-members, listing 200 projects. Write Archeological Institute of America, 675 Commonwealth Avenue, Dept. AFOB, Boston, Mass. 02215, or phone (617) 353-9361.

University Research Expedition Programs. An annual catalog, with seasonal updates, is free. There is a Teacher Research Participation Program for California secondary school teachers. Write the program at the University of California, Berkeley, Calif. 94720, or phone (415) 642-6586.

STUDYING LAKE AS A WHOLE

"Nobody had studied the whole lake," Dr. Harper said. "They had studied particular components, for example the crayfish and islands of floating papyrus, but not in the context of lake fluctuations. The water level has been rising faster than it has in the past 20 years, so we are right on the spot to get that."

Not every volunteer is suited to every task. At Lake Naivasha, one individual bored by lab work swapped for a place on the fish team with someone repelled by dissected fish.

"Some people simply can't force themselves to do the same thing for four hours at a time," said Ms. Magruder of Earthwatch. "They don't know what they can actually do. On the orangutan project, people had to watch orangutans sometimes 100 feet above their heads and write down exactly what the orangutans were doing every two minutes for four hours."

Scientists who have used volunteers emphasize the importance of carefully choosing the tasks volunteers will undertake and of finding out quickly what the individuals in a group do well.

Besides motivation, an important factor for success for a volunteer is physical condition. A volunteer does not have to be a marathon runner but severe weight problems and physical ailments like a bad back can leave a would-be researcher with nothing useful to do. Earthwatch requires volunteers to submit health statements from their physicians.

In addition, "curiosity and a sense of humor are needed," said Kay Wallis of the University Research Expedition Program. "Field conditions can be unpredictable and if you're working with science and nature, you have to be ready for the unexpected. This is not Club Med."

NYT 7-3-90

Researcher Locates Moth-Killing Fungus

ITHACA, N.Y. (UPI)—An insect pathologist reported this week that she has used a fungus to kill off about 85 percent of the gypsy moth caterpillars attacking several oak trees at Cornell University.

In what may be a breakthrough in the war against the forest pest, Ann Hajek, a visiting scientist working at the Boyce Thompson Institute for Plant Research, found the fungus is a deadly natural enemy of gypsy moths.

Hajek said she confirmed the discovery with an experiment conducted over the last few months after large numbers of gypsy moth caterpillars died of a fungal

attack last year in areas of Connecticut and neighboring states.

Hajek determined the deaths were caused by a Japanese fungus called *Entomophaga maimaiga*. The word "mimaiga" means gypsies in Japanese, and Hajek said the fungus is a known enemy of the moths in Japan, Korea and China.

In May, Hajek used 12 pounds of soil from Massachusetts and southeastern New York that contained the fungus and spread it below five oak trees under attack by gypsy moths and two trees where she planted already infected caterpillars.

A month later, the fungus started attacking the gypsy moth caterpillars on those trees and within a few days the insects began dying.

"It will take me probably another month before I have real concrete numbers on all the ways I released the fungus," said Hajek. "I'm sure it's more than 85 percent in that one plot."

The experiment demonstrates the fungus, which is believed to be harmless to other animals, could be used as a biological weapon against the gypsy moth, Hajek said.

Commercial soil preparations containing the fungus could be developed for use by

homeowners and professional foresters to combat gypsy moths, she said.

"We can manipulate the fungus to start a deadly epidemic in gypsy moth populations in infested areas," Hajek said. "I could at least see something maybe for home owners to apply to individual trees."

Gypsy moth caterpillars are woodland pests that have stripped millions of acres of forest.

In a major outbreak in 1980 and 1981, the caterpillars defoliated an estimated 12 million acres through the Northeast.

(continued on page 8)

Kaufman Throws Out Landfill Permit

by Paul Nyden, Staff Writer

Kanawha Circuit Judge Tod J. Kaufman threw out a state board's decision granting a permit to the controversial Irish Mountain landfill. The proposed landfill would be on a mountaintop near where Summers, Raleigh and Fayette counties meet.

Philip J. Gwinn of Green Sulphur Springs applied for the Irish Mountain landfill permit in March 1987. Two years later, on March 17, 1989, Division of Natural Resources Director Ed Hamrick denied the permit. Hamrick stated there was an inadequate access roads leading to the landfill.

Gwinn appealed Hamrick's order. In November 1989, the Water Resources Board reversed Hamrick's action and granted the permit to Gwinn. The board also told Gwinn to submit additional information to DNR.

Tri-County Citizens for Irish Mountain, a local group opposing the landfill, appealed the Water Resources Board ruling on Dec. 21, 1989, two days after Hamrick filed a separate appeal.

Kaufman stated that the Water Resources Board exceeded its authority in granting the permit to Gwinn. "The effect of the board's ruling," Kaufman stated in a six-page opinion, "is to issue a permit to Gwinn without the benefit of a review by DNR of the information which must be submitted under the board's finding."

Kaufman said state law "confers sole authority upon the chief of the Division of Waste Management to issue permits. . . . The board has no statutory authority to receive and review applications for permits and then act upon them by requiring additional information and then issuing the permit sought."

Kaufman reversed the Water Resources Board's ruling and sent the case back to the board for further proceedings.

Hamrick said Wednesday, "I think this is pretty complete victory for us. It is one which may go beyond this particular permit. Judge Kaufman's ruling very clearly indicates that the Water Resources Board can't issue permits"

"I am disappointed that we had to expand valuable resources to adjudicate this matter, when it appeared to be a clear-cut case that could have easily been handled by the board," Hamrick said.

Assistant Attorney General Leonard Kaplan said Wednesday, "The board will pick up the case at the point where Gwinn first brought it to him. DNR is quite content with where things are now. The board can review what DNR did. But the board cannot fix deficient applications itself."

*The Charleston Gazette,
Thursday, July 26, 1990*



Wasps Being Trained To Destroy Crops Pest

Tifton, Ga., June 11 (AP)—Farmers soon may have an environmentally safe alternative to pesticides: swarms of tiny wasps trained seek out and destroy destructive caterpillars.

Researchers at a United States Department of Agriculture laboratory in Tifton are experimenting with odors and colors to enhance the wasp's natural bloodhound ability to find the pests, corn ear worms and tobacco bud worms. The caterpillars, members of the *Heliothis* family, attack at least 100 plants, including corn, cotton, soybeans and tomatoes.

Joe Lewis, an entomologist with the Agriculture Department's Agricultural Research Service, and a visiting Dutch student, Felix Wackers, are raising small wasps known as *Microplitis croceipes*, natural enemies of *Heliothis* insects that do not harm humans.

EVASIVE ACTION BY PESTS

The *Heliothis* pests often try to evade the enemies by hiding in crevices of plants and leaving decoy sites with their scents.

"The wasps are like detectives," Mr. Lewis said. "They're monitoring, eavesdropping. By understanding how they identify clues that signal the caterpillar's presence, we can turn them into an asset."

The female wasp deposits an egg inside the caterpillar while stinging. The egg hatches into a larva, feeds inside the host and eventually kills the caterpillar. The larva then leaves and spins a cocoon, in which it develops into a wasp. As the wasps emerge from the cocoon, the caterpillar odor left on the cocoon is sensed by the wasp and used later to find hosts for its eggs.

To use wasps to kill pests, large numbers will have to be raised in laboratories. But "if you released them in a cornfield and they didn't have any training for worms, they might fly off to another field," said Mr. Wackers. So the researchers have conditioned wasps to recognize the odor of caterpillar feces and to pick out cues like the color and shape of a cotton bloom.

Wasps that received caterpillars as rewards were 90 percent effective in choosing the correct odors and colored cards in flight chamber tests. Similar results were achieved when wasps were released in small plots," said Mr. Lewis.

It has always been assumed that insect behavior was determined by instinct, but Mr. Lewis said his tests showed that the wasps can be trained.

The researchers estimate that by 1995, parasitic wasps could be sent out to patrol full-sized fields.

NYT 6-12-90

Acidity Hits Record Highs On State Streams

by Skip Johnson

The Charleston Gazette (6-8-90)

Record levels of acidity, apparently the result of acid rain, have been found this spring on West Virginia trout streams.

The low among lows was a 3.7 pH reading on Otter Creek in Randolph County. This is acidity similar to that of vinegar, and was a 30-year low since sampling began in the early 1960s.

The Otter Creek reading was made in the sluiceway of the liming device that is located immediately below Condon Run and the Otter Creek headwaters. Condon Run and the Otter headwaters are native brook trout waters.

Another acidic hotspot has been Shavers Fork River, the storied stream that flows off Cheat Mountain at elevations of 3,000 feet and above, eventually reaching the U. S. 33 valley at Bowden east of Elkins. Trout stocking has been come-and-go there all spring because of high acid readings.

A pH low of 5.2 was registered two weeks ago at the downstream end of the popular fish-for-fun area of Shavers Fork. Although there is no regular sampling scheme in place on Shavers, this is a record for late-season readings. The all time flow of 4.9 was recorded several years ago during the peak of the snow runoff in March.

The Division of Natural Resources doesn't stock trout when pH readings fall below 6 (the middle ground between acidity and alkalinity is 7), therefore stocking on Shavers Fork this spring has been sporadic.

Historically, water quality in the headwaters of Shavers near Snowshoe Resort has been relatively good, but gradually declines in the 40-mile stretch between the head and the little village of Bemis, a trout fishing mecca that got no stockings at all in April because of the acid water.

About a dozen tributaries along the way contribute their share of acidity that gradually builds up from Cheat Bridge on U. S. 250 downstream to Bemis. Below Bemis, the river cuts through a limestone region that sweetens the water and makes it palatable for raising trout at the Bowden Federal Hatchery and for fishing on the Shavers Fork along U. S. 33.

The DNR, U. S. Forest Service and U. S. Fish and Wildlife Service are formulating a plan to place limestone fines in some of Shavers' most acidic tributaries in a research project that may ultimately help the troubled river. Pre-treatment data will be collected starting this fall, with actual treatment to follow next year. At least that's the goal.

Although some stockings were made on Shavers, the DNR is concerned about the numbers of fish remaining, especially in the fish-for-fun stretch.

A third stream with record acidity problems is Middle Fork of Tygart River from the Randolph County community of Cassidy upstream to the headwaters. The pH hasn't gotten up to 6 all spring, and for the first time ever the DNR has been unable to stock a single trout. The pH has remained in the low 5 range.

Cranberry River, which until the advent of the limestone drums on Dogway Fork would have joined the acid crowd, has had all its stockings on schedule this spring—no cancellations.

This means the money spent on the Dogway facility, and the money scheduled to be spent on a second facility on North Fork of Cranberry, is money well spent.

Since there is no other likely reason for the jump in acidity on the aforementioned streams, the suspected culprit is acid rain. The mountains of West Virginia got double the normal rainfall in May, which translates to greater doses of acidity.

Submitted by Carroll Jett

(continued from page 7)

"My message then is that business's response has fallen short in two areas: in the legislative arena, by contributing to public distrust, which leads to regulations that may be more costly than necessary; and in the internal management area, where organizational initiatives have failed to change the behavior of front-line employees, and where too few companies have capitalized on changes in demand for their products. The results have been unsatisfactory for industry, and for the country generally. Growing environmental challenges and the intensity of public opinion on this subject call for a more fruitful response."

John C. Sawhill, President and CEO The Nature Conservancy, "How to Think About the Environment." Delivered to The Business Council, Hot Springs, Virginia, May 11, 1990. From VITAL SPEECHES, Vol. LVI, No. 18.

The moths were imported into Massachusetts more than a century ago in an attempt to create a silk industry in the United States.

Hajek identified the fungus as one that was imported into the country in 1909 by a Harvard University professor, who later released it in suburban areas of Boston.

The fungus has since spread throughout Massachusetts and Connecticut, as well as parts of New Hampshire, Vermont, New York, New Jersey and Pennsylvania.

"In Japan it crops up in gypsy moth populations quite frequently," said Hajek. "Both last year and this year in central Massachusetts there have been big die-offs from this fungus."

The fungus produces microscopic spores that invade the skin of the caterpillar and then multiply quickly as a fungus, devouring the insect from the inside, she said.

The institute is a private and independent research organization at Cornell University.