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## Ecological Laboratory

### Phasing in Preservation

Pine Cabin Run Ecological Laboratory has defined its work well. Certified by the West Virginia Department of Health and approved by EPA for drinking water testing, the lab collects data that are scientifically valid and admissible as evidence in a court of law.

A special interest in the Cacapon River distinguishes the Pine Cabin Run Lab. A three year study is designed to document the health of the river. The goal of long-term monitoring will continue recording the river's vital signs.

Whenever environmental degradation is detected the Lab will sound a warning. Working closely with the citizens action group — The Cacapon River Committee — scientific data is being used to develop a comprehensive land-use plan. A quarterly newsletter is mailed to patrons.

Emphasis is placed on the *ecological health* by measuring and following indicators that reflect the entire ecosystem. The Lab studies turbidity, pH, fecal coliform bacteria, aquatic macrophytes, benthic insects, riparian birds and mammals and rock bass.

Dr. George Constantz, Director, describes the unique perspective of the Lab: "From an ecological point of view, the Cacapon River basin may be treated as an entire ecosystem, which is defined as the set of living organisms as well as the non-living soil, water, and air that interact within a given area. Man is affecting the Cacapon ecosystem via three dominant pollutants: silt from erosion, sewage from malfunctioning septic systems, and acid imported by prevailing winds. Although the Cacapon has been lucky and is still in relatively good health, time is running out.

For more information or to become a patron write:

Dr. George Constantz, Director  
Pine Cabin Run Ecological  
Laboratory  
Route 1, Box 469  
High View, WV 26808  
(304/856-3911)

## Acid Rain Research May Boost Center

By Zion Johnson  
The Pittsburgh Press

The University of Pittsburgh's Center for Hazardous Materials Research enjoys a reputation for having the largest collection of documents and research on such materials in the state,

says Edgar Berkey, president of the center.

And officials there consider the recent addition of acid rain research as a way to bolster that recognition across the state and country.

"We're always seeking ways of im-

proving our status and our service capabilities," Berkey said.

The center is owned by the university and housed at the Applied Research Center in Harmarville. It acts as a clearinghouse, providing information

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## National Guard Doing Projects in Six State Parks & State Forests

By Mary Wimmer  
WV Sierra Club

Surprise! The WV National Guard is doing engineering/construction training in six of our State Parks/Forests this summer, and you will likely run into them. They are doing several service projects coordinated with the State Department of Commerce. The Environmental Assessment prepared for these projects did not undergo any public review. It is difficult to comment on projects when no maps or details of the activity are provided. I was told that the draft copy I was sent to comment on was really a final copy and that no changes would be made; the comments I wrote on the inadequacy of the EA will simply be attached to it! Yes, we still have a ways to go to get to acceptable military EA's and public involvement in the decision-making process.

The projects to be conducted are in Blackwater Falls, Canaan Valley, Cathedral, Tygart Lake, and Valley Falls State Parks, and Coopers Rock State Forest. Most of the projects involve earth-disturbing activities. Please observe whenever you can (I was not given the dates of the projects either, although the Coopers Rock one has begun) and call Ron Fortney, WV DOC, at 348-2764 or me if you notice problems with erosion control, stream sedimentation, or other unacceptable disturbance. After last year's fiasco on Canaan Loop Road, including major soil exposure unprotected from erosion, and culverts draining upward (?), we must keep a close eye on these activities.

## 1st Annual Statewide Environmental Convention to meet Sept. 15-17 at Cedar Lakes

By Norm Steenstra

There have been state-wide environmental conferences in the past. There have also been opportunities for environmentally sensitive people to discuss issues with state political leaders. At other times, informational seminars have been held. And on one other occasion (January 13, 1989) environmentalists from across the state met to arrive at a consensus of legislative priorities.

The state-wide environmental convention will feature all of the above opportunities. The convention will be held on the weekend of September 15-17 at Cedar Lakes Conference Center.

Invitations to more than 50 civic and environmental organizations have been sent, with the request that group representatives attend.

Specific seminars on the groundwater bill, the recycling petition drive, US-EPA resources available to environmental groups, the state legislative process and a panel discussion on the role of the environmental community in political campaigns will be held.

The featured speaker will be Speaker of the House Chuck Chambers, who will be in residence throughout the convention and will lead seminars on the legislative process as well as participate in the panel discussion. Other seminar leaders and panel participants are yet to be determined.

The weekend convention will be an informative yet low-keyed opportunity for environmentalists throughout the state to exchange ideas, define their organizational structure, identify long-range goals and arrive at a consensus of priorities for the 1990 legislative session.

The Cedar Lakes Conference Center is owned and operated by the WV Department of Education and is located 30 miles north of Charleston near Ripley, WV. Attendance is unfortunately limited to 100 people. The cost of the weekend, including two nights of dormitory lodging and five meals is \$60.00 per person. For additional information or reservations, please contact Norm Steenstra at WV Citizen Action Group; 346-5891.

## NPDES Permit

Judy's Fencecraft has applied for a National Pollutant Discharge Elimination System (NPDES) permit for a wood treatment plant at Bartow in Pocahontas County. The application is currently pending.

Although Judy's Fencecraft has been making fencing for approximately fifteen years, it has been able to make it from red spruce in the past. Red spruce's natural properties make it suitable for fencing without chemical treatment.

Because the supply of available red spruce has been reduced, Judy's Fencecraft intends to begin using white pine. Because white pine lacks the decay resistant properties of red spruce, it is necessary to chemically treat white pine before it is suitable for fencing.

So as to be able to chemically treat wood, Judy's Fencecraft has applied for a NPDES permit for its facility at Bartow. This application is being reviewed by the West Virginia Department of Natural Resources. Among the controversial aspects of this chemical wood treatment facility is its location in or near the flood plain.

More information on this proposal is available from the West Virginia Department of Natural Resources.

## National Celebration of the Outdoors

The May issue of the *VOICE* had an article on Earth Day suggesting that in 1990 some one should organize a worldwide event commemorating the 20th anniversary of Earth Day 1970.

The committee for a National Celebration of the Outdoors is proposing a week-long series of events April 22-29 to do just this nationwide. They point out that everywhere open space is vanishing and the environment is being threatened. They want to build a strong constituency that will ensure that land issues are addressed.

They are not asking for money. Instead they ask that those interested in the environment form coalitions in their own communities. Some environmental issues have to be tackled at the national or state level. But even more need to be addressed at the local level. To name but a few: recycling, waste management, wetlands, subdivision growth, open space, trails, park-type recreational opportunities.

The committee is calling on elected officials, conservation and environmental groups, civic organizations and business leaders to do two things:

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## Near Desert Resorts, A Threatened Lizard Gets Its Own Refuge

By Jane E. Brody

The Coachella Valley fringe-toed lizard is unusual in more than its name. It is now the only lizard in the world with \$25 million worth of real estate.

The land is in the form of three preserves set aside in the scrubby, windswept desert here to try to save the highly specialized and secretive reptile, which faces extinction.

A habitat conservation plan formulated for the lizard under the Endangered Species Act has become a national model for rescuing threatened species. The plan allows the endangered animal to thrive despite continued economic growth and avoids prolonged and costly litigation.

Two years after the plan took effect, its formulators still marvel that more than a dozen disparate and often conflicting interest groups managed to forge it without a court battle. And Dr. Allan Muth, an ecologist who heads a citizens' watchdog committee, said, "Thus far the plan is working even better than anyone expected."

What remains to be seen is whether the lizard manages to survive in the land bought in its behalf with funds from federal and state agencies, area developers and the Nature Conservancy, a private organization that raises money to buy ecologically critical land.

### 'Only Patch of Native Desert'

"If this works, we'll get much more than just a lizard," Dr. Muth said. "We got a glorious patch of desert that is also home to the round-tailed ground squirrel, another candidate for the endangered species list, the flat-tailed horned lizard, burrowing owls, raptures of all kinds, unique flowering plants, including some already listed as endangered, and half a dozen kinds of large insects that are endemic to the valley."

He added, "In 10 or 20 years, this reserve will be the Central Park of Coachella Valley, the only patch of native desert left when the rest of the valley is built up."

The Coachella Valley fringe-toed lizard lives solely in this part of the southern California desert near Palm Springs, where expansive resorts and million-dollar homes are sprouting faster than dandelions in a Long Island lawn.

Early in the 1970's, Wilbur Mayhew, a zoologist at the University of California at Riverside, realized the lizard's days were numbered as bulldozers chewed up the Coachella Valley sand dunes and windbreaks were erected to stop the flow of fine sand essential to its survival. By 1980 more than half its original turf of 267 square miles had been lost to urban and agricultural development and the rest was undergoing degradation.

Finally, the lizard was listed as endangered by California and as threatened by the United States Fish and Wildlife Service. The number of surviving lizards is not known.

The fringe-toed lizard is well adapted to its hostile environment. The nine-inch-long reptile is as comfortable in sand as a fish is in water. In fact, the lizard is colloquially known as a sandswimmer. It races smoothly across the sizzling sand and, when threatened with predation or excessive heat, dives headlong into the sand and disappears in an instant.

A number of adaptations to the usual lizard anatomy make this possible. Several were described by Robert C. Stebbins, a herpetologist at the University of California at Berkeley in the 1940's, the rest in the early 1980's by James Cornett, curator of the Palm Springs Desert Museum.

The lizard gets its name from the elongated fringe-like scales on the hind legs that act like snowshoes, increasing surface area and improving traction both on and under the sand. Its snout is wedge-shaped and its body flattened and covered with small round scales that give it a slinky surface. These characteristics reduce friction when it dives into sand, torpedoing with its front legs tucked against the body.

A lower jaw sunk under the upper creates a tight seal that prevents the lizard from getting sand in its mouth when it dives. To keep sand out of its eyes, it has a double set of lids that overlap and interlock. Any sand that gets through this barricade is trapped by mucus and collected in the corner of the eye for later removal. The ears, too, are protected by a fringe of enlarged scales. And, to keep sand out of the respiratory tract, the nasal passage is U-shaped, like the trap under a sink. When the lizard surfaces, it snorts out sand that has accumulated in the trap.

The lizard is able to remain submerged indefinitely, breathing the air found between sand grains. Dr. Cornett showed that the position of the front legs keeps sand from filling in the space under the chest when it contracts during exhalation; otherwise subsequent inhalations would become increasingly difficult.

Analysis of the lizard's turf has shown that it is very particular about the sand on which it lives. It must be loose, windblown sand, known as blowsand, and the grains must be no smaller than one-tenth of a millimeter and no larger than one millimeter in diameter, Dr. Muth said.

Coachella Valley sand comes from violent storms that wash it down from mountains to the west. The sand is then sorted and blown by strong northwest winds that funnel through a mountain pass, Dr. Muth explained.

Any barrier, natural or manmade, that inhibits the flow of windblown sand in effect destroys the lizard's habitat. But human developments need windbreaks as protection against blowing sand. When pushed by environmentalists to protect the lizard from extinction, the Fish and Wildlife Service at first tried to stop all development in the valley.

### Compromising on Conservation

Battle lines were drawn. The county, with tax dollars at risk, sided with developers trying to construct luxury homes, golf courses and resorts, and a court fight seemed inevitable. Then environmentally concerned citizens, who lacked money to sustain years of litigation, suggested a compromise made possible by a 1982 amendment to the Endangered Species Act. The measure allows the incidental taking of a protected species if certain conservation steps are carried out.

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With the aid of a local lawyer, Paul Selzer, developers, environmentalists and county, state and federal agencies worked out the habitat conservation plan, a 100-page document spelling out the best scientific guess as to what would be needed to preserve the lizard in perpetuity.

"Merely preserving land now occupied by the lizard would not be enough," Dr. Muth explained as he showed a visitor around the dunes. "The lizard's habitat depends on a continual supply of blowsand, so a critical part of the plan was preserving a sand source that would not be blocked by windbreaks."

He said developers were delighted with the concept of creating, as they put it, "a park for the lizard" that would then allow them to develop the rest of the valley. The eventual plan established a 13,000-acre reserve, called the Coachella Valley Preserve, and two small satellite reserves in different parts of the valley.

"Although only 10 percent of the lizard's historic range is included in the reserves, they contain essentially 100 percent of the habitat that has a long-term probability of remaining viable," said Dr. Muth, who is director of the Deep Canyon Research Center of the University of California at Riverside.

To pay for the land, all coffers were tapped. The Nature Conservancy provided \$2 million, said Cameron Barrows, manager of the organization in southern California and now also director of the preserve. Then, he said, money was contributed by the federal and state governments and area builders. Anyone who wishes to develop a

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**Near Desert Resorts** (Continued from Page 2)

part of the valley once occupied by the lizard must pay \$600 an acre toward its preservation.

**'A Model Mechanism'**

This "mitigation fee" has turned out to be a boon to developers, Mr. Barrows said, because "it saves time and time is money." By defining in advance the lizard's original range, the plan averts litigation over every new parcel to be developed.

Mr. Barrows said the habitat conservation plan was "a model mechanism, if it is done properly." He added, "It does the right thing to protect an endangered species and an ecosystem and at the same time it allows intelligent development to proceed."

A similar approach is now being considered to save the Stevens kangaroo rat that lives in coastal sage scrub between Riverside and San Diego, one of the nation's fastest-growing areas. Other tests of the approach are under way in the Florida Keys and near Bakersfield, Calif., to save a variety of threatened species.

Karen Sausman, director of the Living Desert, a desert zoo and botanical garden here that breeds endangered desert species, said she has nothing but the highest praise for what has been done for the Coachella Valley lizard in getting such diverse interest groups together. "It will serve as a stepping stone to habitat preservation for species throughout the country," she said.

*The New York Times/June 6, 1989.*

## Monitoring West Virginia's Water Quality: Watch Out!

By Mary Wimmer, WV Sierra Club

Keeping track of the water quality in West Virginia's 28,361 miles of rivers and streams is no small task. The job rests primarily with the Water Resources Division of the WV Department of Natural Resources, and also involves the Departments of Energy, Health, Agriculture, Commerce, and Highways. As the representatives of WV Sierra Club on the State Water Quality Advisory Committee (WQAC), I have begun to learn about the condition of WV's water quality monitoring and evaluation programs, and I would like to briefly fill you in on the current situation. I think you will see that the West Virginia public must get more involved in protecting the quality of our State waters, for much work needs to be done.

First let me say that, except for groundwater protection and soil erosion control legislation, the federal and state laws that exist to protect WV's water quality are in reasonable shape. The legal framework is almost there, in other words, so that we can focus on monitoring and enforcement of the laws, and here we have a long way to go. Groundwater protection legislation has been introduced in the WV legislature the past two years. The Chambers-Humphries Bill is the version that will meet groundwater protection goals, and which the House overwhelmingly passed this year. The "industry-controlled" (to say the least) State Senate killed the bill, but we will be back until we get it through. **We must not compromise any further on this legislation**, for as you will see, even with a good legal framework, our valuable water resources are far from being protected.

The federal Clean Water Act, Section 305(b), requires each state to compile a report assessing the quality of the state's surface and groundwater, the location and types of degradation that exist, and the major sources of that contamination. The latest report is the 1985-87 Assessment, and I will summarize some of the key points. Anyone can obtain a copy by writing to the Water Resources Division, WV DNR, 1201 Greenbrier St., Charleston, WV 25311. It will provide you with a start at evaluating the status of WV streams of interest to you.

The state is divided into drainage basins to generate areas of manageable size. Within each basin, rivers are classified according to "designated

uses," and the water quality is then assessed as to whether or not that water can support its "designated use." For example, some streams are used as public drinking water supplies or trout habitat and therefore require a higher degree of purity than streams used for agriculture or recreation. With some type of "assessment" done on half of West Virginia's rivers and streams, **only 20% of our river miles are reported to fully support the uses they are designated to be able to support.** 71% are partially supporting, and 9% are too contaminated to support their designated use.

The major causes of contamination in our rivers and streams are mine drainage, sewage, and nonpoint sources, which comes as no surprise. The latter include low pH due to acid mine drainage or acid precipitation; siltation from timbering, mineral extraction, construction, and agriculture practices; and nutrients from fertilizer and feed-lot runoff from agricultural lands. This illustrates the other legislative need in West Virginia, a **soil erosion control bill** which industry is also strongly opposed to in spite of the major problem of sedimentation in our state's waters. It will be up to us citizens to correct this situation through pressure on our governor and state legislators.

Now to the question of how good is the assessment as well as our critical water quality monitoring programs for NPDES permittees. EPA has recently conducted a series of eight studies over a period of time to determine how well laboratories who do water testing nationwide can perform these tests. The region in which West Virginia lies ranked on the average of eight out of the 10 regions, so not well to begin with. Even more disturbing, the major West Virginia labs doing water quality testing for permit requirements ranked LAST in our region in every study except one. The percents of West Virginia permittees who could perform acceptable analyses were as follows for the eight studies: 24%; 32%; 37%; 29%; 54%; 35%; 46%; and 53%. Would you trust the water quality of your favorite stream to one of these labs?

What the EPA study is telling you is that when a coal company, chemical company, landfill operation, or other entity applies for a permit from the

**National Celebration of the Outdoors**

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- Form coalitions and task forces to plan for the future of their community by addressing the open space and environmental problems.

- Plan a series of events for the week of April 22-29 to tell citizens about what is being done, describe why such action is needed, show them how beneficial and enjoyable it is to have rivers to canoe or trails to hike and enlist their support.

The committee will supply information and suggestions to those interested in joining the effort. For more information, write to: National Celebration of the Outdoors, 1250 24th St., NW., 5th Floor, Washington, D.C. 20037.

**Acid Rain Research**

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and collecting more while doing research on hazardous materials issues for private and governmental agencies.

It is expanding its focus to include acid rain after signing a five-year agreement last month with the Bipartisan Legislative Acid Rain Caucus.

Over the next two weeks, the caucus, made up of 40 state legislators, will provide the center with documents, reports and transcripts from legislative hearings.

The center is a not-for-profit organization and is providing the service at no cost to the caucus. At the end of the five-year term, it may renew or cancel the agreement.

Caucus Chairman Rep. John Broujos, D-Carlisle, said the documents, which would fill "a couple of file cabinets," were generated by research and studies done by the group since it was formed in 1984.

The center will store, categorize and package the material, which is now kept in an office at the state Capitol, for public use, Broujos said.

He said the group appealed to all state colleges and universities to serve as the clearinghouse for the information, but only Pitt stepped forward.

Colleges and universities were targeted because they have the capacity to store and catalog information and function as research centers. "We wanted the documents to be available for public use," Broujos said.

State Rep. Thomas Michlovic, D-North Braddock, who is secretary of the caucus, said the acid rain clearinghouse "will enable distribution far better than we could offer in the House."

Berkey said having the information at the center will provide good access for students, legislators and individuals at private firms who want to study acid rain.

Environmentalists and lawmakers are studying the detrimental effects of acid rain — formed when toxic gases are released into the air — on lakes, forests and human health.

Because of the clearinghouse's location, officials anticipate a large demand for information. "Pittsburgh has a special position in acid rain; we are both a major producer and a major recipient of acid rain," Berkey said.

He said the center's staff will work with the university's School of Library and Information Sciences while indexing, cataloging and referencing the material.

"The information has to be easily accessible. Right now, it's just in a bunch of boxes."

The material will be kept with other hazardous materials documents in a room of about 500 square feet.

Berkey said that his long-term plans for the center include using the information for research projects on a contract basis.

A \$500,000 grant earlier this year from the state Department of Environmental Resources will help offset any additional costs that the center, which has a staff of 30 people, will incur.

The grant also helps the center provide assistance to private and governmental agencies in dealing with hazardous waste management problems.

The assistance program includes a hotline, 1-800-334-CHMR, a quarterly newsletter, seminars and consultations.



# Living Streams

By Jenni Vincent and Linda Cooper Elkinton

*New project aims to stop further toxic acid mine drainage in Northern WV Coal Fields*

Although acid mine drainage is expressly prohibited by West Virginia law, new sources of it continue to destroy countless streams in north central West Virginia and other areas across the country. Some estimate that destruction is occurring in West Virginia at the rate of one stream per week.

With a new project called "Living Streams," local community groups and citizen activists have a new, effective resource to help fight to protect rivers and streams from acid mine drainage.



**PRETTY AS A PICTURE** — Although small and babbling in places, Hugh Radcliff, President of the Laurel Run Watershed Community Association often leads interested visitors on a tour which includes both large and small watersheds. Surrounded by mountain laurel, rhododendron, trees and moss-covered boulders, Radcliff says that this is the perfect spot to spend a day (pictured).

Aiming to stop acid mine drainage and empower local individuals and groups, the project is being developed and spearheaded by WV Mountain Stream Monitors (MSM), a citizens/conservation organization dedicated to the protection of water quality. The effort is envisioned by its organizers as an opportunity to go beyond anything that has been done before in the battle to prevent the environmental damage that results from acid mine drainage.

Tired of having to "re-invent the wheel," each time a different community is faced with a permit application for acid mine drainage-producing coal mining, MSM plans to provide necessary, independent technical and legal services when and where it is required.

MSM, WVHC, Trout Unlimited and numerous other state conservation organizations have been involved in protests which range from Hooram Creek in Webster County to Aarons Creek near Morgantown. They have witnessed first hand the value of making such information available to those who wish to protect their streams by legally protesting and opposing coal mining and land disturbances that would produce acid mine drainage.

Tom Rodd, a Morgantown attorney who has worked with many local groups, explains that the pollution of these smaller streams also has huge implications for the extended watersheds. He sees a recent trend where "more and more individuals and small community groups are being forced to take action to protect the streams that traverse their property or community."

"The technical and legal issues involved in each individual case are nearly always identical," he notes, "and these ad hoc stream fights are very important. But one stream at a time is a difficult way to deal with this problem, and not the most effective way. A broader based approach is needed."

Rodd explains that too many small communities simply can't afford the technical and legal work that is required.

"As a result, we have lost and are continuing to lose many highly productive and incredibly beautiful streams, many that serve as superior and invaluable drinking water supplies and resources."

The Living Streams project thus plans to develop informational materials on the causes, effects and prevention of acid mine drainage for distribution to local community groups, mine industry officials, regulators and policymakers. The project proposal states that the time has come to make sure all of the costs of this kind of water quality destruction and the other environmental degradation involved with it are fully added into the cost equation of mining coal. On a policy level, making this important cost information available and readily accessible to all involved is one of the primary aims of the project.

"With pre-mining analysis of rocks above and below the coal seams and other tests, we can now, with very high levels of confidence, predict which sites will be acid-producing," states Richard diPretoro, a hydrogeologic consultant who has worked with many local community groups, "and we must, most aggressively, apply this knowledge to prevent the damage acid mine drainage is causing."

To achieve this goal, Living Streams will, if and when necessary, pursue appropriate legal action in the public interest to prevent any mining that will result in the production of toxic acid mine drainage.

Technically, acid mine drainage is defined as water with a pH of less than six that is associated with the mining of coal. Released into a stream, the toxic substance destroys streamlife and often turns the streambed yellow/orange.

DiPretoro notes that orange rocks from iron precipitation represents only the most visible effects of acid mine drainage, and that much more than aesthetics are at stake when a stream is subjected to these toxics.

DiPretoro notes that orange rocks from iron precipitation represents only the most visible effects of acid mine drainage, and that much more than aesthetics are at stake when a stream is subjected to these toxics.

"The cumulative and long-term effects are enormous," he points out. "The acidity, dissolved metals and sulphur compounds render the water useless for most purposes for decades. A stream's food chain is broken, the taste of the water changes and the combination of pollutants affects everything from fish and wildlife to water supplies for cattle and property owners."

The project proposal reports that the effects of acid drainage are very far-reaching. They involve not only the destruction of water quality and drinking water supplies but they also decrease property values and eliminate both recreational opportunities and future commercial, industrial and economic growth potential in a community.

Far from being a problem only of small streams, acid mine drainage is a factor in many of the state's major rivers as well. The Cheat River is completely lifeless in much of Preston County due to acid mine drainage. Tygart River and Tygart Lake have suffered numerous fish kills and presently support a game fish population only because of costly, perpetual, artificial treatment of acid mine drainage in the headwaters — some of which is financed at public expense. In addition, a number of former high-quality trout streams in the Buckhannon River system are now barren.

(Continued on Page 5)



Living Streams (Continued from Page 4)

Because absolutely no proven reclamation technology is available to effectively eliminate and prevent acid mine drainage and because the State is apparently saddled with a permanently ineffective regulatory system, Living Streams is designed to demonstrate that effective private action on this issue can be undertaken and coordinated to stop mining that will result in acid mine drainage.

Citing MSM's involvement in the Buckhannon, Tygart, Cheat, Middle Fork, Little Kanawha and Birch Rivers, Living Streams will work with State and regional conservation/citizens organizations as well as local communities to insure the integrity of State waters that will otherwise be sacrificed to acid mine drainage. Targeting sixteen counties in north-central West Virginia, Living Streams will maintain a constant vigil on coal mining applications in that area and coordinate direct legal action required to prevent further acid mine drainage from occurring.

The proposal for the project emphasizes that now is the time for action, since few State watersheds will be spared the effects of acid mine drainage within the next 10 years unless something is done.

"It's an issue that has been around for a very long time" says Rodd, "but with the increase in mining activity in recent years (under the Moore administration and now continuing under Caperton), we're probably now losing a stream a week."

Hugh Radcliff, president of the Laurel Run Watershed Community Association, an organization to whom Rodd and MSM have provided assistance, feels quite strongly about the need for Living Streams.

Having already faced the challenge of organizing a community in anticipation of a strip mine that would have affected Laurel Creek, Radcliff learned first-hand how expensive and difficult such an effort can be.

"Because many private individuals and community groups may not have the legal or financial resources they need, a project such as Living Streams will fill a tremendous void," Radcliff says.

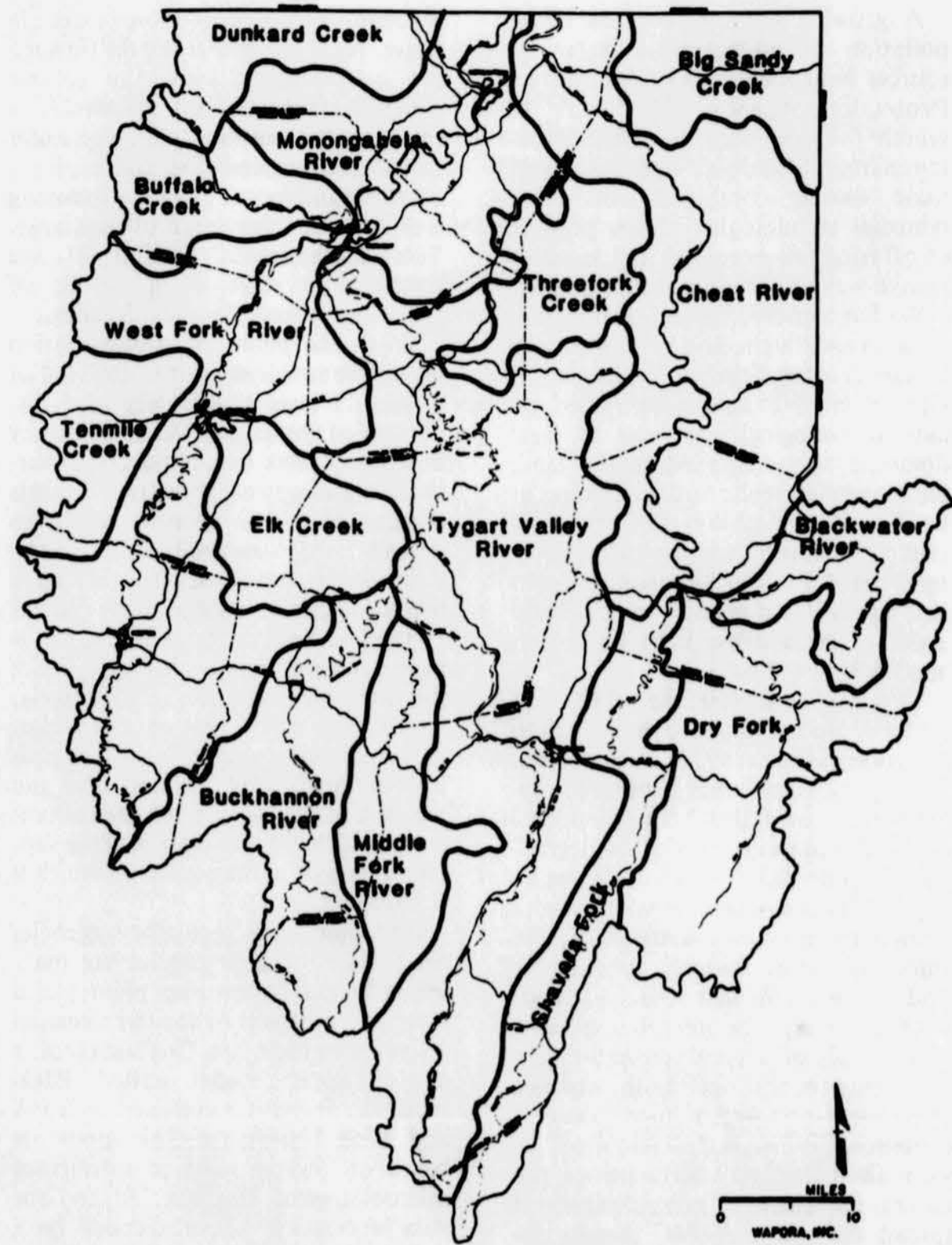
Now in the Phase I (proposal) stage, a major fund-raising effort is underway with State conservation organizations and private foundations. Phase II is designed as a start-up period and will include formalizing information gathering and dissemination to the public. Phase III, projected for July, 1990, will bring the project into full swing.

Donations to support Living Streams and help prevent further damage to WV waterways from toxic acid mine drainage are needed. Checks may be written payable to "Living Streams" and mailed to WVSOM, P.O. Box 170, Morgantown, WV 26505.



**PICTURE THIS** — Local residents fear that additional stripping near Gladesville (in Monongalia County) will produce acid mine drainage — which will seriously impact on the Laurel Run Watershed. Now a high quality trout stream and water source (pictured here), members of the Laurel Run Watershed Community Association are working to preserve it.

MAJOR SUB-BASINS IN THE MONONGAHELA RIVER BASIN (WAPORA 1981)



**Magic Words**  
(after Nalungiaq)

*In the very earliest times,  
when both people and animals lived  
on earth,  
a person could become an animal if  
he wanted to  
and an animal could become a  
human being.  
Sometimes they were people  
and sometimes animals  
and there was no difference.  
All spoke the same language.  
That was the time when words were  
like magic.*

*The human mind had mysterious  
powers.  
A word spoken by chance  
might have strange consequences.  
It would suddenly come alive  
and what people wanted to happen  
could happen —  
all you had to do was say it.  
Nobody could explain this:  
That's the way it was.  
From Shaking the Pumpkin*

**Diagnosing Pollution**

Diagnosis of air pollution injury to vegetation is a complicated process. Factors governing plant growth are complex and interrelated. An observer should understand the basic procedures of diagnosis, know what background information to seek, and understand how to interpret information.

The following logical sequence of seven questions\* forms the basis of the diagnosis of suspected air pollution injury to vegetation:

1. Is there a pollution source nearby capable of causing injury?
2. What are the characteristics of the terrain or location?
3. What are the symptoms of injury

4. What is the distribution of affected plants?
5. Are biological agents present?
6. Is more than one species of plant affected?
7. What is the crop industry of the affected area?

A systematic approach should be utilized to ensure individual bias does not influence diagnosis.

The scientific study of the effects of air pollution on vegetation is still a young field. More research is needed to resolve many unanswered questions. Gaps in information must sometimes be completed by an "educated guess."

Individual differences exist in plants as in all living things and they sometimes react differently to identical stimuli. Variables influencing plant thresholds to pollutants include age, size, and genetic structure.

More than one air pollutant may be present in the ambient air at the same time. Plants are often exposed to a mixture of pollutants. The effect of these mixtures on plants may be less than, equal to, or greater than the effects of any single pollutant in the mixture. Plant pathogens and air pollutants may also interact to modify the disease response of the plant. Only a few of the more obvious combinations have been studied.

During the 1950's the chemical constituent of smog were identified as the result of a series of atmospheric reactions between hydrocarbons and oxides of nitrogen from automobile exhaust in the presence of sunlight. The photochemical oxidant most studied, peroxyacetyl nitrate (PAN), is believed to cause the most damage.

Sulfur dioxide (SO<sub>2</sub>) may oxidize in reactions in the dark. The sulfuric acid mist that forms, better known as acid rain, is readily dissolved in rain or snow. SO<sub>2</sub> is one of the first man-made pollutants to cause damage to vegetation. An air pollution regulation by

(Continued on Page 7)



## Learning to Use Microbes to Clean Up Groundwater

By John Wilson

A growing national concern about pollution of underground water resources has encouraged Environmental Protection Agency researchers to search for new ways to remove contaminants. Microbial degradation of toxic wastes, combined with other remedial technologies, shows promise of offering less expensive and more effective ways to remove the pollutants.

We have studied the self-purification of lakes and rivers, and rely on natural processes to treat the wastes discharged into them. We have long relied on natural biological processes to treat domestic wastes applied to the land, either through septic tank discharges or by land farming. We now recognize that these same natural biological processes can destroy contaminants in soils and aquifers that result from leaks and spills or from disposal of hazardous materials to the land.

In a pristine aquifer, each glassful of water is exposed to more than a billion microorganisms that are busy extracting organic compounds in order to support their own lives. Their appetite keeps the concentration of biodegradable organic matter very low. When an aquifer becomes contaminated with something they can metabolize, the microorganisms quickly proliferate and gobble up the new source of food.

Occasionally, the microbes exhaust their supply of oxygen before the contaminants are removed. In the absence of oxygen, removal of biodegradable contaminants is often inhibited or stops altogether. As a consequence, the natural movement of groundwater will spread the contaminants, thereby increasing the threat of human exposure.

Several important classes of hazardous wastes can be degraded biologically. Spills and leaks of petroleum products from underground storage tanks are probably the most common example; others include certain wood-creosoting wastes or refinery sludges, and coal tars left from the production of illuminating gas in the era before electric lighting. The latter are of increasing concern because most of the former sites of the old gas plants are still contaminated with these tars, and many are located in what are now the centers of our cities.

All of these wastes are primarily (or entirely) composed of natural organic compounds, mostly hydrocarbons, that are oily and only slightly soluble in water. They are considered hazardous because they often contain cancer-causing compounds such as benzene or benzo(a)pyrene, but they can be biologically degraded if oxygen is present.

When oily material is released to the earth, it drains through the unsaturated zone (above the water table) under the influence of gravity. Because it becomes trapped in the pore spaces, some of the oily material is left behind, while the remainder drains down to the water table. The water table moves up and down under the influence of pumping or annual cycles of precipitation. This fluctuation smears the oily material through the aquifer and allows laterally-moving groundwater to become contaminated.

Contrary to the old adage, oil and water do mix. The more water-soluble components of the oily waste, such as

benzene, can dissolve to some extent in water. As groundwater moves through the contaminated area, the soluble components of the oil material dissolve, each according to its particular chemical characteristics, and a plume develops and moves toward a pumping well or some other point of discharge. This contaminated portion of the aquifer can serve as a source of groundwater pollution for decades.

When the plume of contamination leaves the source area, it is depleted of oxygen. However, diffusion and dispersion of the groundwater ultimately bring the plume into contact with surrounding oxygenated water; when this occurs, the microorganisms' ability to degrade the dissolved waste compounds is restored. Under such favorable circumstances, many plumes — the areas of contaminated water — have a natural limit to their size. Since the rate of degradation is, effectively, the rate at which oxygen can be introduced to the plume, it is often possible to predict the ultimate size and location of the plume from the concentration of the contaminant and the supply of oxygen in the aquifer in which it is harbored.

EPA and state regulatory agencies need tools that can predict the maximum extent of existing plumes and forecast the effects of various remedial activities on their size. One such tool, a mathematical model called BIOPLUME, is being developed by EPA and Rice University. The model is based on several years of subsurface microbiological research led by our Ada laboratory, whose scientists have pulled together a multi-disciplinary team of microbiologists, hydrologists, geological engineers, analytical chemists, and computer scientists. The model will be supported by a manual which provides guidance on appropriate use of the model, and contains standard operating procedures to obtain the site-specific information required for its use. A version of the model, designed to run on an IBM AT personal computer, will be ready for general distribution late this year.

Although it is possible to reduce the size and life expectancy of contaminant plumes by the addition of oxygen and other nutrients, some may not require remedial action because natural processes alone are adequate. If the hydrogeology of a contaminated site permits these natural processes to be characterized, BIOPLUME can be used to address the fate of the plume. It can also be used to estimate the effects of remedial action technologies.

Although the scientific basis of bio-restoration is well understood, actual application of the technology to hazardous wastes sites is inhibited by a lack of information on its performance at field scale. There are a number of research projects now underway to evaluate the performance of this technology, to more accurately define the optimum operating conditions, to minimize costs, and to develop new approaches for bio-restoration.

The basic concepts of natural or enhanced biodegradation to restore contaminated groundwater complement more commonly used engineering approaches such as pumping and treat-

## AIPM and the Gypsy Moth

*Appalachian Integrated Pest Management Demonstration Project has its Project Office at 180 Canfield Street, Morgantown, WV 26505 (304/291-4891). The following dated releases come from this office. Related articles in the Voice included the November 1988 and April 1989 issues.*

May 25, 1989

NEW MARKET, VA — Not all gypsy moth spraying in the Shenandoah Valley last week was for the sole purpose of controlling the gypsy moth population. A project conducted on the George Washington National Forest near Wolf's Gap had the additional purpose of developing improved methods for future use in gypsy moth control.

In this study, researchers working with the Appalachian Integrated Pest Management Project (AIPM) are studying the use of the bacterial insecticide *Bacillus thuringiensis* (BT). Many people consider BT preferable to chemical insecticides for use in residential areas, over water sources and in other environmentally sensitive areas. The "knock" against BT has been its inability to significantly reduce gypsy moth populations. While many gypsy moth larvae are killed by BT and foliage is protected during the year of application, population surveys indicate that enough larvae survive to repopulate the area next year necessitating additional control procedures.

The George Washington study is testing a new formulation of BT called Foray 48 B developed by the Novo Laboratories of Danbury, CT. In one documented test, Foray has been successful in significantly reducing gypsy moth populations. AIPM is testing Foray at various dose rates as well as with and without a diluting agent. Water effectively dilutes BT including Foray, but tends to evaporate diluent, the evaporation problem will be solved.

Twenty-five blocks of thirty acres each were sprayed as part of the test. The results will be evaluated by (1) deposit estimates (2) larval counts, (3) egg mass surveys and (4) amount of defoliation.

The deposit estimates are made by actually climbing the tree, collecting leaf samples, and then photographing each leaf, under special lighting conditions to determine the amount of material that has landed on it. This is a tedious and exacting process.

According to Normand Dubois, Research Microbiologist, USDA Forest Service, Hamden, CT, "This work can bring about a significant breakthrough in gypsy moth control. However, the work proceeds slowly as only so much

ing, excavation, or the creation of isolation barriers. The latter are most evident and cost-effective in dealing with heavily contaminated materials, while biotreatment is most promising when dealing with lower concentrations. Because the two approaches complement each other, they will be most fruitful when used as tandem remedial action technologies. The challenge remains to identify the conditions under which each is most appropriate and the proper staging for their application.

EPA Journal  
June 1987

can be done in any one year and we must wait for the next year's larval population to conduct the next phase of the study."

For more information on this study or the AIPM Project contact AIPM project headquarters in Morgantown, West Virginia (304) 291-4891, the George Washington National Forest or your county extension agent.

June 8, 1989

PETERSBURG, WV — The West Virginia Department of Agriculture (WVDA) in cooperation with the Appalachian Integrated Pest Management Project (AIPM) has treated 23,727 acres of West Virginia forest lands to minimize the adverse impacts and slow the spread of the gypsy moth. Treatment occurred primarily in Hardy, Grant, and Preston counties.

The gypsy moth is a defoliating insect whose caterpillar stage feeds on the leaves of forest and shade trees. Imported to the United States over 120 years ago, this pest has been steadily expanding its range south and westward along the Appalachian Mountains and has now entered Virginia and West Virginia.

The AIPM project involves federal, state and county governments in a cooperative effort to slow the spread of this forest pest. In this year's West Virginia treatment, the largest to date for AIPM, the Department of Agriculture applied the insect growth regulator diflubenzuron (trade name Dimilin), and the bacterial insecticide *Bacillus thuringiensis* (Bt) in areas known to have increasing populations of the gypsy moth.

These treatments will not only protect this year's foliage and help prevent tree mortality, but will also reduce the populations of gypsy moth which can carry over and multiply next year. The gypsy moth caterpillars feed on foliage in the months of May, June and July. According to Department of Agriculture Forest Entomologist Alan Miller "The project was not completed on schedule due to this spring's cool, wet weather." Miller explained "We must have the right combination of foliage and caterpillar development." If the foliage is too small, it provides an insufficient space for the material to adhere to and be devoured by the caterpillars. If the caterpillars are too large, the materials are ineffective in controlling them.

The chemical Dimilin interferes with the production of the material (called chitin) used to form the insects exoskeleton. It has been shown that diflubenzuron is harmless to humans, mammals, birds, fish, reptiles and honey bees. Bt is a bacterium and it affects only moths and butterflies. The aircraft used on the project included three Beechcraft twin-engine planes and 1 DC-3. The actual dose rate of Dimilin used was 1/2 oz. of active ingredient per acre.



# SHIFTING PRIORITIES

By R. Neil Sampson  
Executive Vice President, American Forestry Association

## Priorities for Conservation have been cut in Half

The federal budget is about more than dollars and deficits — it is a statement of the nation's priorities. We invest our resources — and our attention — on those activities and issues that concern us most.

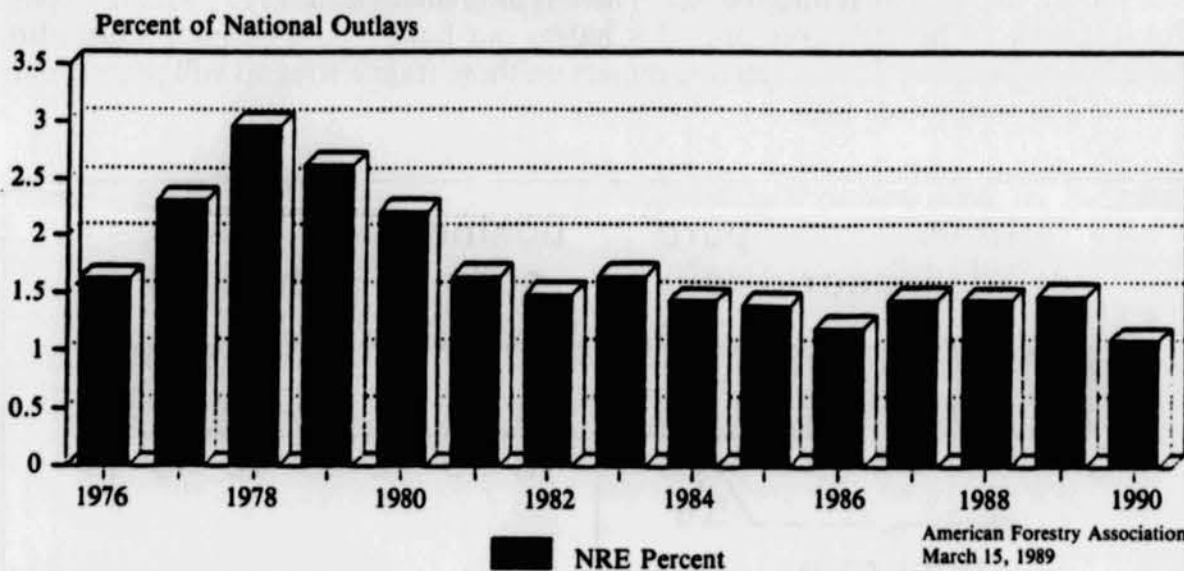
By that measure, the national concern for natural resources, conservation and the environment is significantly lower today than it was a decade ago. In 1978, the United States spent 2.98 cents out of every federal dollar on natural resources and the environment. By 1989, that figure had fallen by 50% — to 1.48 cents out of each dollar. If the Reagan budget proposals were to be enacted into actual appropriations, that figure would drop to 1.1 cents in 1990.

Figure 1 shows the trend revealed by a study of federal budgets over the last 15 years. In looking at the trend, it is important to realize that this shift in national priorities has, through 1989, been what the Congress has enacted — often by significantly increasing the requests of the Administration. The 1990 estimate comes from the Reagan budget proposals. Congress will, and should, establish different priorities. But a 1990 budget in the range of 1.5 cents on the dollar will only be achieved with hard work on the part of the natural resource community and its supporters in the Congress. Any hope of regaining the relative priorities of the 1978 level will only be realized with significant changes in the national political constituency for natural resource, conservation and environmental issues and programs. (Date Source: *Historical Tables, Budget of the United States Government, Fiscal Year 1990*)

A Look at the Federal Budget for Natural Resources and the Environment in the Reagan Years

Figure 1.

## NATURAL RESOURCES AND ENVIRONMENT BUDGETS



## Diagnosing Pollution

(Continued from Page 5)

royal proclamation of Queen Elizabeth I, in the 16th century, prohibited the burning of coal in London when Parliament was in session.

The sources of pollution may be broadly classified as industrial, urban, mobile and rural. With the atmosphere as medium, air pollutants are emitted and transported from source to receptor.

Pollutants can be emitted from a point source such as a power plant, a line source as a highway, or an area source such as a city or large industrial complex. The emission point may be close to the ground, the tailpipe of a car, or over a thousand feet in height, the stacks of a power plant. Time of emission is important. Meteorological conditions vary throughout the day. The atmosphere is more stable at night.

Attempts are still being made to accurately characterize the vertical and horizontal dispersion of pollution by using mathematical models. Less than satisfactory results are due to the variables in size, topography of areas receiving emissions and amounts of emissions.

Wind direction and speed are concerned mostly with horizontal movement of the air containing pollutants. The dilution of a pollutant is directly proportional to the wind speed. The

speed of the wind being one factor that determines the volume of air that passes an area.

The stability of the atmosphere is concerned with the vertical mixing of pollutants. On a clear day, with the sun shining, the warmed earth transfers its heat by conduction and radiation to the atmosphere near the ground. As this warm air rises the cooler, denser air of the upper atmosphere descends. Given these conditions, any pollutants would be rapidly dispersed.

The opposite of these ideal conditions — a temperature inversion — is the result of a stable atmosphere. Pollutants emitted into a stable atmosphere where little or no exchange is taking place does not disperse quickly.

The local topography of an area can interact with meteorological variables to affect the dispersion of pollutants. Mountains can act as a barrier over which pollutants cannot flow. Valleys can become pockets that fill with pollutants, especially in stable atmospheric conditions. On a smaller scale, a row of buildings or trees can act as a barrier or a channel for air pollution.

Given all these variables, plant tolerances have been identified for some species. In some studies "bio-indicators" were used. Certain plant species known to be sensitive indicators of air pollutants were monitored.

## Priority Shifts Within the Natural Resources Function

Within the Natural Resources and Environment Function, significant elements of resource agency budgets are grouped within five general categories. They are:

### Water Resources

Examples: Bureau of Reclamation, Corps of Engineers.

### Conservation and Land Management

Examples: Forest Service, Bureau of Land Management, Soil Conservation Service, Mining Reclamation, Conservation Reserve, Arctic National Wildlife Refuge

### Pollution Control and Abatement

Examples: Environmental Protection Agency, Superfund, Oil Pollution funds

### Recreation and Parks

Examples: National Park Service, Fish & Wildlife Service

### Other Natural Resources

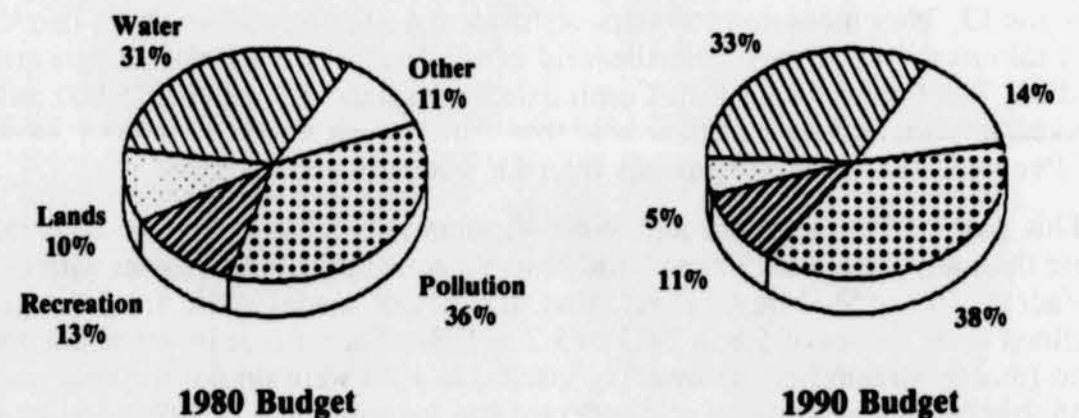
Examples: Geological Survey, Bureau of Mines, National Oceanic and Atmospheric Administration

Figure 2 indicates the priority shifts between the 1980 actual budget and the 1990 Reagan proposal. Water resource development, pollution control, and other functions each move up 2-3 percent. Recreation and Parks would be cut 2%, but the conservation and land management function — already the smallest part of the pie, would suffer a 50% cut. All figures shown include the benefit from offsetting receipts as predicted in the 1990 budget documents (and documented for prior years). Thus, they amount to the net national investment in these activities.

Prepared for The Natural Resources Council of America

Figure 2

## Natural Resources & Environment Priorities of the 1980's



Lichens have been widely used in Germany and Canada.

Plants take life from the surrounding environment. Plants are responsive to and dependent upon the environment. Environmental patterns of unusual nature stress plants. Response of each individual plant depends on characteristics and structure. A good method to assess damage must be central to any air quality guidelines. Assessment of damage and determina-

tion of economic losses still lacks a comprehensive theoretical basis. Variations exist from state to state and from county to county.

Standards for air quality are set at levels to prevent health effects from occurring. The data taken into consideration acknowledges the presence of only one gas in the atmosphere. This is not an accurate description of the concentrations and reactions occurring in the atmosphere.

## \*Toxic Flags

"The first report that one pollutant might affect the response of plants to another pollutant was noted in the early 1950's in California. When researchers equipped greenhouses with water-spray scrubbers to remove sulfur dioxide from the ambient air, they observed increased ambient oxidant injury to Pinto beans. The researchers postulated that either the sulfur dioxide mitigated the effects of the oxidants or the plants were more sensitive at the higher humidity. A few years later, it was found that with an SO<sub>2</sub> to O<sub>3</sub> ratio of 6:1, symptoms of both pollutants appeared. When the ratio was lowered to 5:1, ozone symptoms predominated and no interference from SO<sub>2</sub> was noted. When the ratio was lowered to 4:1, the ozone appeared to interfere with the expected SO<sub>2</sub> injury symptoms. No evidence of increased injury was reported with the pollutant mixtures. No interacting effects were found on gladiolus when fumigated with combinations of SO<sub>2</sub> and HF or SO<sub>2</sub> and hydrocarbons. Likewise, propylene and acetylene did not interfere with the development of foliar symptoms from products of irradiated propylene-NO<sub>2</sub> mixtures. It was found in 1966 that certain cultivars of tobacco were slightly injured when fumigated with 0.24 ppm of SO<sub>2</sub> or 0.03 ppm of O<sub>3</sub> for two to four hours. However, when the tobacco cultivars were exposed to a mixture of the two pollutants, the level of injury increased to moderate. These results suggested some type of potentiation mechanism or synergism between the pollutants and stimulated new research efforts."

Diagnosing Vegetation Caused by Air Pollution  
EPA Publication No. 450/3-78-005



# Acid Rain Reductions Needed to Protect All Eastern Trout Streams

By Donald C. Gasper

West Virginia brook trout are near the southern end of the brook trout range, and they are restricted to the highest elevations where cool pure water still exists. Many of these mountain tops consists of hard, resistant sandstone and hence the streams draining them carry few nutrients and alkalinities. These small trout populations are threatened on all sides by warmer water and its minnows. There is no place left to which they can retreat. Even the very sky today seems to be their enemy as acid rain further endangers their fragile, otherwise undisturbed watersheds.

Acid rain has not increased in the last five to eight years, but it has been an astonishing 50 lbs./ac/yr. as sulphuric acid in West Virginia and western Pennsylvania for a decade. In this region it has a pH of 4.1 or 4.2. This means a 25' wide trout stream in a year will have over 200 tons of acid falling into its watershed at this pH which is ten times more acid than historically. Year-round it is only half neutralized, and in the springtime these streams carry much acid.

What neutralization occurs is at the expense of soil nutrient reserves. Acid rain gradually dissolves the nutrients from these already geologically infertile watersheds until today they are impoverished and some of the streams draining them contain too few nutrients to support even a brook trout population. These streams have become "too pure for trout." With so little alkalinity (a portion of the nutrients are alkaline) these watersheds cannot neutralize so much acid rain, so the stream is acid.

There are 200 miles of otherwise suitable brook trout streams in W. Va. in, and just west of the Monongahela National Forest that have no fish. Over 1/4 of W. Va.'s trout streams are only a little richer and are endangered by present levels of acid rain.

The Cranberry River is typical of this group. Fish were sampled in 1957, 1966 and again in 1986 and 1987 at five places in this nearly 20 miles. In over 30 years its fish population decreased from 15lbs/ac to less than five. A continued similar reduction indicates there would be no resident fish in five more years. The fish species were reduced from 15 in 1957 to 12 in 1966 and eight today. The Cranberry drains a wilderness area on the National Forest where this is not supposed to happen. It is clear biological evidence of stream, and hence, watershed acidification.

Similar fish loss was described by six Pennsylvania State University Hydrologists, soils scientist and fish biologists in 1984 in The Journal of Environmental Quality, Volume 13. They measured soil impoverishment occurring and attribute fish loss to acid rain in the three most infertile/acid of the four western Pennsylvania streams studied. The Pennsylvania Fish Commission considers 30% of their 5,000 miles of stocked streams and 40% of their wild trout streams endangered, and that over half the Pennsylvania trout streams less than 13' wide are endangered.

This part of Pennsylvania and West Virginia gets 50 lbs/ac/yr of acid rain — more than anywhere else. Recent studies in Virginia indicate fish losses with only 25 lbs/ac/yr. In the St. Mary's River, that also drains a wilderness area, the pH has declined from values of 6.8 in 1983 to 5.2 in 1988. The aquatic invertebrate populations (mostly stream bottom dwelling insects) in 1976 were similar to those found in 1936, but by 1986 only a few acid tollerant species remained. In 1976 good numbers of brook trout and even rainbow trout and minnows were present, but 1986 and 1988 data showed a sharp reduction of rainbow and minnows. Loss of fish has also been found in Virginia in and near Shenandoah National Park. In sampling 350 of Virginia's 450 trout streams, they found 78% to be "sensitive" and half to be "extremely" so, and 11% were "acidified" with no or greatly reduced fish populations. Careful chemical studies of one stream showed a pH drop from 5.6 to 5.3 over eight years. They estimate the blacknose dace was present in all but 3% of these streams originally, today they are absent from 19% and in the future (without relief from acid rain) they will be absent from 70%. The Virginia brook trout fishing heritage would be reduced by 63%! This fish loss occurs with 25 lbs/ac/yr acid rain.

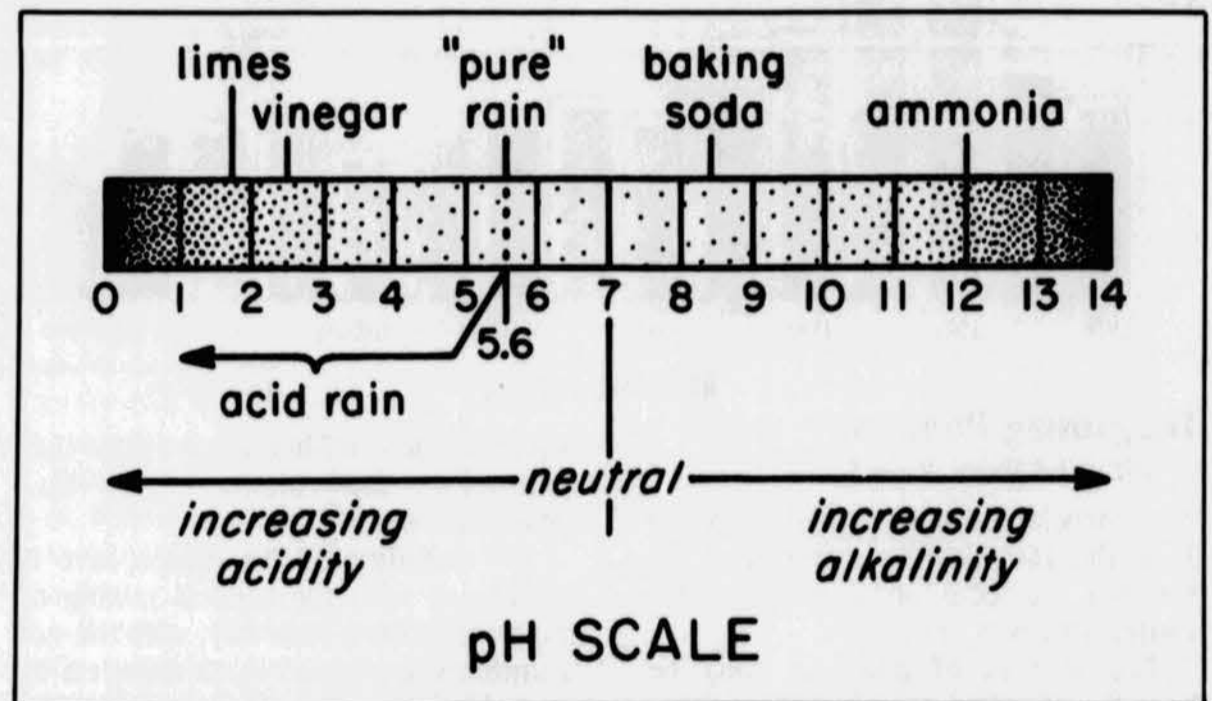
A 35 year chemical record of a stream feeding the Boston Water Supply shows gradual acidification, and a typically acid reduced fishery has occurred in the reservoir. In nearby Massachusetts streams, fish checks showed the fairly acid-tollerant brook trout to persist in acidifying streams, but associated species were lost between 1955 and 1975. They get even less acid rain.

It is at last clear that 25 lbs/ac/yr will cause fish loss — permanent, fish loss. A reduction in sulphur emissions from 24 to 12 million tons should theoretically reduce West Virginia and western Pennsylvania from 50 to 25 lbs/ac/yr acid rain. This is just what Virginia and Massachusetts gets today! This is the maximum clean-up considered in Washington to date. The proposals of the House, Senate and E.P.A. will be only a 10 million reduction. This will leave this region of the U.S. silently slowly acidifying, losing its fisheries. Can a Federal Law fail to adequately protect a region like this — placing this portion of the U.S. fishing heritage so clearly now at risk?

Clearly also we need a prompt and thorough clean-up of sulphur emissions. An 18 million ton reduction might produce a pH about 4.8, and this is perhaps only twice as much acid as before World War II and the 1940's. This is more like, for eons, what our forests, soils, waters and trout are accustomed to. The clean-up must be a "crash" program, perhaps requiring a new source of funding — a "Superfund II." If we give power companies the money, we can give them the clean-up schedule required to preserve these eastern U.S. trout fisheries and the biological integrity of their watersheds and forests.

Perhaps 1/10 of eastern trout streams are at risk or are being seriously degraded — perhaps irreversibly so. The fragile trout streams in this region of West Virginia and Pennsylvania can serve as early warning systems, alerting the east to further environmental degradation. Eastern fisheries will be more productive and safeguarded if these fisheries are preserved.

This biological information is of the most awful kind — after the fact, permanent fish losses. This is not the subtle, unconvincing chemical evidence, but this new information occurring now is like cannon roars from everywhere in the east receiving 25 lbs/ac/yr. The increasing frequency of fish loss requires attention. It is legislatively very late, but fish loss is the biological imperative to balance the socio-economic considerations that have so far formed the Clean-air Act. We have only one month to integrate it into the Act. There is little doubt citizens are willing to pay for it. Clean air benefits everyone. If it harms our buildings, a clean-up must also have health benefits. The intolerable impact on these fragile streams will protect our forests and watersheds too.



## Reasons to join WVHC

The West Virginia Highlands Conservancy is a private, non-profit environmental organization started in 1967. Its objectives are "to promote, encourage, and work for the conservation — including both preservation and wise use — and appreciation of the scenic, historic, open space, wilderness, and outdoor recreation resources of and related to West Virginia, and especially the Highlands Region . . ."

Members include people and organizations diverse in their personal interests and professions but united by a common interest. Most WVHC members are West Virginians but many live outside the state.

The Highlands Voice, a monthly

8-page newspaper, is sent to all Conservancy members. It is filled with environmental news on topics of interest and concern to members as well as articles about trips and outings.

The Conservancy sponsors two special weekends each year. These are usually at some scenic spot in the highlands and feature speakers, outings and board meetings.

Your contribution to WVHC is tax deductible and joining is as simple as filling out this form and returning it to the office in Charleston.

Join today and become part of an active organization dedicated to preserving West Virginia's natural resources.

### WVHC Membership Categories (Circle One)

Category	Individual	Family	Organization
Senior/Student	\$ 12	\$ —	\$ —
Regular	15	25	50
Associate	30	50	100
Sustaining	50	100	200
Patron	100	200	400
Mountaineer	200	300	600

Name: \_\_\_\_\_ Phone: \_\_\_\_\_

Address: \_\_\_\_\_

City/State/Zip \_\_\_\_\_

Make checks payable to: West Virginia Highlands Conservancy

Mail to: P.O. Box 306, Charleston, WV 25321

#### Membership Benefits

- 1-year subscription to **The Highlands Voice**
- Special meetings with workshops and speakers
- Representation through WVHC's efforts to monitor legislative activity.

The West Virginia Highlands Conservancy is a non-profit organization. Your contribution is tax-deductible. Please keep this for your records.

Date \_\_\_\_\_

Amount \_\_\_\_\_

Check number \_\_\_\_\_