

# Nonpoint Source News-Notes

The Condition of the Water-Related Environment  
The Control of Nonpoint Sources of Water Pollution  
The Ecological Management & Restoration of Watersheds

## Notes on the National Scene

### Legislation Update

#### U.S. House of Representatives

The Government Reform Committee has approved H.R. 944 (July 18, 1995) which requires that agencies review existing regulations with an annual economic impact of at least \$100 million over a seven-year period and modify or revoke all that are "unnecessary, outdated, or overly burdensome to regulated parties." Any unreviewed regulation would be revoked by default. If passed, this legislation may have an impact on environmental regulations, including those regulations relating to nonpoint source.

H.R. 961, the Clean Water Act revisions, passed the House May 16, 1995 (See *News-Notes*, #41).

#### U.S. Senate

The full committee on Environment and Public Works has no markup or committee sessions scheduled on key issues, chief of which are the Clean Water Act and the Endangered Species Act.

The President's Farm Bill guidance went to the Senate on May 11. The bill, approved by the Senate Agriculture Committee on September 28, would no longer allow the government to buy

### INSIDE THIS ISSUE

#### Notes on the National Scene

Legislation Update . . . . . 1

#### Notes on Riparian and Watershed Management

Magic at Clean Lakes Project . . . . . 2  
Does Better Land Management Mean Better Water Quality? . . . . . 4  
Water Quality is in the Eye of the Beholder . . . . . 5  
Is Adoption of Orphan NPS Sites Feasible? . . . . . 6  
TVA's Shoreline Initiative Shines . . . . . 7

#### Urban Runoff Notes

Development Seeks to Limit Sprawl . . . . . 9  
Runoff Controls Please the Senses and the Pocketbook . . . . . 12  
South Carolina Development Stewardship Award . . . . . 12  
An Alternative to Thirsty Turf Grasses . . . . . 13  
Study Links Property Value to Lake Water Quality . . . . . 14

#### Notes on Agriculture

Operation and Maintenance Targeted in Waste Lagoon Failures . . . . . 15  
Comprehensive Farm Planning in Great Lakes Basin . . . . . 16  
Pollution Prevention at Chemical Mixing Sites . . . . . 17

#### News from the States, Tribes, and Localities

Missouri Grassland Management Works . . . . . 17

Suburban Nevada Ranchers Reduce NPS . . . . . 18

#### Technical Notes

Lower Tire Pressure Reduces Sediment from Logging Roads . . . . . 20  
Studies Address Nitrate Removal from Groundwater . . . . . 21

#### Notes on Environmental Education

How Do You Develop Local Stewardship? . . . . . 23  
Touch-Screen Technology Enlivens Education . . . . . 24  
The Greening of the Schoolyards . . . . . 25  
Georgia Adopt-A-Stream Goes Hi-Tech . . . . . 25

#### NPS Electronic Bulletin Board News

NPS Information Exchanges Moves to the 'Net . . . . . 26

#### Reviews and Announcements

A Citizen's Guide to Riparian Area Management . . . . . 27  
"Snapshot" of Nation's Natural Resources . . . . . 28  
Video Presents Facts on Cryptosporidium . . . . . 28  
Council Supports Habitat Enhancement . . . . . 28

#### DATEBOOK

. . . . . 29

#### THE COUPON

. . . . . 31

All issues of *News-Notes* are stored in downloadable files on the *NPS Electronic Bulletin Board System*. Additionally, the *NPS BBS* contains a searchable database that allows the user to search for and retrieve *News-Notes* articles on specific topics. To access the database from the main menu, type OPEN. See page 26 for log-on information.

permanent easements under the Wetlands Reserve Program but would instead pay to take wetlands out of production for shorter-term periods. The Conservation Reserve Program, which pays farmers to take environmentally sensitive lands out of production, would be capped at the current level of 36.4 million acres. The bill would combine all other conservation programs into a new program, the Environmental Quality Incentives Program, focused on problems of livestock waste management. Farm programs continue to be highly contentious for members of the House of Representatives, who still cannot agree on a future direction (see *News-Notes*, #41 for highlights of the House bill).

S. 851, the Wetlands Regulations Reform Act was introduced by Senator Bennett Johnston (D-La.), to amend the Clean Water Act and the wetlands regulatory program. Hearings were held July 19 and Aug 2, 1995. This bill is the Senate's counterpart to H.R. 961.

S. 854, the Agricultural Resources Conservation Act of 1995, was introduced by Senator Lugar (R-Ind.), to amend the Food Security Act of 1985 to improve the resource conservation program. It was referred May 25 to Senate Committee on Agriculture, Nutrition, and Forestry.

S. 93, the Ecosystem Management Act, was introduced by Senator Mark Hatfield (R-Ore.). It was referred January 4 to the Senate Committee on Energy and Natural Resources. There are no companion or counterpart bills at this time and no markups or committee reports.

S. 768, the Endangered Species Act, was introduced by Senator Slade Gorton (R-Wash.). No action is scheduled and no counterpart or companion bills are noted at this time.

The Senate passed EPA's appropriations bill, H.R. 2099, on Wednesday, September 27 by a vote of 55 to 45, largely along party lines. Senator Bob Kerry of Nebraska was the only Democrat who supported the bill. The Senate amended the bill to give EPA an appropriation of roughly \$5.7 billion, a 22 percent cut from FY95, but \$700 million more than the House's approved budget for the agency. Differences between the House bill, which includes a 33 percent EPA cut and legislative riders, and the Senate version, with seven legislative riders, must now be reconciled before a joint House/Senate conference committee. The final conference report must then pass both the full House and Senate and be signed by the President. The President is expected to veto the measure.

The Senate Environment and Public Works Committee is working with EPA to develop source water protection language in a Senate Safe Drinking Water Act reauthorization. Such a program would protect surface water in a way similar to the wellhead protection program that protects groundwater.

---

## *Magic at Work in McCullom Lake — A Clean Lakes Project*

by Anne Weinberg, *Environmental Protection Specialist, Assessment and Watershed Protection Division,  
U.S. Environmental Protection Agency*

Something magical has been happening at McCullom Lake in McHenry County, Illinois.

During my late summer visit to the lake, Bob Kirschner, principal environmental planner with the Northeastern Illinois Planning Commission, described how effort and a little bit of magic were improving the condition of the lake. Carp were eradicated from the lake in 1993, thanks to a federal Clean Lakes Program Phase II grant from U.S. EPA. Kirschner, one of the key organizers of this effort, said that prior to 1993 the water in McCullom Lake was cloudy because thousands of carp stirred up bottom sediment. Water clarity averaged less than 12 inches. Since the carp removal, water clarity extends to the lake bottom — as much as 12 feet.

After the carp removal, another partner in the project, the Illinois Department of Natural Resources, restocked the lake with thousands of fingerling game fish. Now McCullom Lake supports a more balanced and thriving fishery.

Then, this spring, the magic began. Herbicide treatments were planned to curtail the growth of Eurasian water milfoil which had spread to nearly 70 percent of the lake. But when the ice disappeared on McCullom Lake on March 15, there were only a few strands of water milfoil to be found in the lake.

An early suspect for this almost magical decline of water milfoil was an aquatic weevil native to North America called *Euhrychiopsis lecontei*, but its role in the event was not confirmed until June, when Kirschner and lake resident Bill Moerschbaeher discovered several strands of milfoil hosting more than 15 of the hungry weevils. This, Kirschner believes, is the first confirmed sighting of the weevil in connection with a significant decline of the Eurasian water milfoil in Illinois.

Because the weevil feeds exclusively on milfoil species, it has the potential to be an effective biological control. Similar declines of water milfoil have been connected to this insect in Vermont, Connecticut, Wisconsin, Washington, Ontario, and British Columbia. Thus, the phenomenon is promising, but additional research is needed to fully understand the insect's role against the water milfoil nuisance in McCullom and other lakes across the country. According to Kirschner, we have much to learn about the weevil's life cycle and behavior before we can consider it an effective and reliable milfoil management strategy.

These dramatic events highlight only two aspects of the multifaceted McCullom Lake cleanup. The federal Clean Lakes Program Phase II implementation grant, awarded in August 1993, underlies comprehensive efforts to restore the lake's recreational uses and provide for its long-term ecological protection. In addition to the carp eradication effort, the program helped fund and install

- a wintertime aeration system,
- various shoreline stabilization efforts,
- watershed management planning, and
- a lawn fertilizer education program.

For 20 years, the federal Clean Lakes Program has pioneered many aspects of the Watershed Protection Approach, emphasizing geographic targeting of high priority lakes, watershed assessment, implementation of needed controls, and coordination with other programs. EPA has provided \$145 million to states and tribes to improve lake quality under the program established by Section 314 of the 1972 Clean Water Act.

### **Illinois Implements State Lake Program Modeled on the Federal Clean Lakes Program**

On July 1, the state of Illinois inaugurated "Conservation 2000," a multifaceted, six-year state initiative aimed at protecting natural resources and expanding outdoor recreational activities. The Illinois Clean Lakes Program (ICLP), a key component of the initiative, is a state-funded version of the federal Clean Lakes Program (CLP).

The new program offers diagnostic and implementation grants using guidelines and requirements similar to the CLP's. A funding level of \$500,000 has been appropriated for the first year of the program, with authorizations planned to exceed \$1 million in each of the following five years.

The expanded inland lakes program, administered by the Illinois Environmental Protection Agency (IEPA), will implement the Illinois Lake Management Program Act Administrative Framework Plan. Current lake management efforts will be expanded, as will technical and financial assistance, monitoring and research, and environmental education.

IEPA is currently developing the administrative guidelines for this program. The agency will hire more staff to provide one-on-one technical assistance to lake owners and managers.

*[For more information regarding this program, contact Gregg Good, Lakes Program Supervisor, Illinois Environmental Protection Agency, 2200 Churchill Road, P.O. 19276, Springfield, IL 62794-9276. Phone: (217) 782-3362.]*

The McCullom Lake project has benefited from the active participation of a number of partners from all levels of government, including the city of McHenry, the Northeastern Illinois Planning Commission, the Illinois Environmental Protection Agency, the Illinois Department of Natural Resources, and the U.S. EPA's Clean Lakes Program.

A little bit of magic? Yes. And planning, hard work, and cooperation are making the future brighter for McCullom Lake. Stay-tuned — we'll let you know what's under the ice next spring!

*[For more information on McCullom Lake, contact Bob Kirschner at the Northeastern Illinois Planning Commission, 222 South Riverside Plaza, Suite 1800, Chicago, IL 60606. Phone: (312) 454-0400. Or Pete Merkel, McHenry City Parks and Recreation Department, 333 South Green Street, McHenry, IL 60050-5642. Phone: (815) 363-2160.*

*For more information on the federal Clean Lakes Program, contact Anne Weinberg, U.S. Environmental Protection Agency, 401 M Street Southwest, 4503F, Washington, DC 20460.]*

---

## Does Better Land Management Mean Better Water Quality? Taking the Measure of a Successful Watershed Project

Adapted from articles in *Fields & Streets*, the newsletter for Wisconsin's Nonpoint Source Water Pollution Abatement Program, April 1993 and March 1994.

Cleaner water is still the bottom line in the Wisconsin Nonpoint Source Program — Do our streams run clearer? Are our lakes free from algal blooms? Is the fishing better than it used to be?

These straightforward questions can be surprisingly difficult to answer. Phosphorus accumulated in lake bottom sediments, for example, will affect a lake long after conservation practices have dramatically reduced phosphorus loadings in runoff. Similarly, fish, insects, and other biological indicators of a healthy stream may not reach acceptable levels until many years after water quality improves and riparian habitat is restored. In short, measuring real improvement in water quality across an entire watershed is inherently a long-term process.

How can we balance these scientific realities with everyone's immediate interest in seeing that improvement efforts are really making a difference in priority watersheds? Roger Bannerman and his colleagues at the Wisconsin Department of Natural Resources (DNR) may have the answer.

### *Signs of Success*

By observing changes in riparian and in-stream habitats and gathering biological monitoring data, the DNR's Signs of Success program provides early evidence of BMP benefits that, according to Michael Miller, a DNR water resources specialist, "you don't have to be a scientist to appreciate." "It's a quick, semiquantitative measure of the effectiveness of these practices, useful in educating landowners, taxpayers, and legislators on the value of BMPs," Miller says. Since 1993, DNR and county staff have selected one or two new watershed projects each year for the program.

Signs of Success focuses on BMPs such as barnyard runoff controls, better manure management, streambank fencing, and other practices that should have an early effect on adjacent streams and lakes. DNR staff also seek urban sites for monitoring under the program.

### *Study of Two Farms Reveals BMP Benefits*

In 1994, the DNR compared two farms in the Onion River watershed under the Signs of Success program, one with and one without BMPs. The Onion River watershed, draining 100 square miles, joins the Sheboygan River, a tributary of Lake Michigan.

Farm A did not participate in a 1980s' priority watershed program that cost-shared BMPs in the watershed. In contrast, Wilber Bohnhoff and son Gene, owners of Farm B, took advantage of the program to install several management practices in 1987 and 1988. Observes Miller, "All you have to do is compare these two sites to see the difference land management practices can make in the biological integrity of a stream."

- **Without BMPs.** On Farm A, 100 cattle had access to the river, resulting in overgrazed riparian vegetation, trampled streambanks, and widening of the stream channel. The increase in the width of the stream reduced water depth and stream velocity, causing an increase in water temperature and filling stream pools and shallows with sediment. Biologists sampled the segment of the river adjacent to Farm A and found only one trout.
- **With BMPs.** On Farm B, the Bohnhoffs installed barnyard runoff controls, manure storage, upland soil conservation measures, and streambank fencing to limit cattle access while still allowing the livestock to drink from and cross the stream. Compared to Farm A, the stream segment adjacent to Farm B was narrower and deeper, had greater velocity, and was less affected by sediment. It also had more riparian and in-stream vegetation, and more diverse populations with a greater number of aquatic species indicative of healthy streams. Fish population sampling along this segment revealed more brown trout, including young-of-the-year, and several additional nongame species.

As the Onion River study suggests, Wisconsin's Signs of Success program offers a method to provide early evidence of the success of BMPs. Miller senses that "these early results will allow watershed managers to show the benefits of BMPs and encourage additional landowners to actively participate in watershed programs."

[For more information, contact Michael A. Miller, Water Resources Specialist, Bureau of Water Resources Management, Wisconsin Department of Natural Resources, 101 S. Webster Street, P.O. Box 7921, Madison, WI 53707-7921. Phone: (608) 267-2753; Fax: (608) 267-2800.]

## Water Quality, like Beauty, Is in the Eye of the Beholder

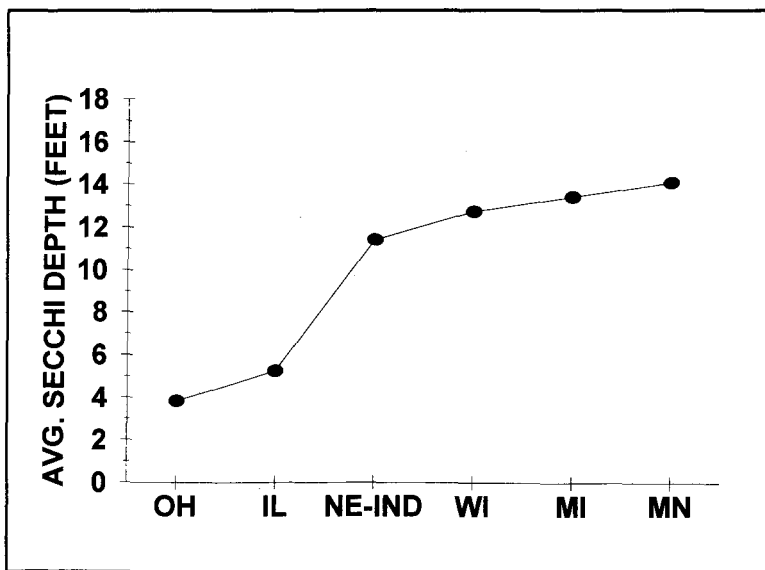
In July 1995, volunteers from 38 states and two Canadian provinces participated in the second annual Great All-American Secchi Dip-In. While this year's results are not yet in, Robert Carlson, a Kent State University limnologist, reports that data compiled from last year's Dip-In has yielded an intriguing outcome.

When asked to rate their lake's water quality on a scale from "excellent" to "severely impaired," participants in the Dip-In indicated that clarity plays a greater role in the perception of water quality in some regions than in others. For example, in Ohio, some volunteers reading Secchi transparencies of six inches perceived the water quality as "excellent," while a Minnesota volunteer found a lake with a 10-foot transparency to be "impaired."

Carlson, who co-directs the Dip-In program with Kent State geographer Jay Lee, provides two possible explanations for these regional differences. It is possible, he said, that volunteers find some other factor more important than transparency in determining water quality. Volunteers from most states ranked algae as the most significant pollution problem. Since the relationship between algae and transparency makes them mutually important determinants of water quality, Carlson believes the real explanation is that people have simply become accustomed to the prevailing condition of their lakes.

There is no scale to indicate the level of transparency that corresponds with degraded water quality, Carlson explains. "You ask people if they think a lake is degraded at six inches of transparency; you don't tell them it is." Because of this fact, he adds, water quality managers may face situations in which "transparency is low, but people think the lake is in excellent condition."

Consequently, in addition to balancing the costs and benefits of improving lakes, managers must also determine what level of quality the community deems appropriate. If a lake is used for fishing, it is likely that public support exists for minimizing damage to, or even restoring, a high quality aquatic habitat.



This graph represents the mean Secchi depth transparency reading (in feet), by state, for lakes determined by Dip-In volunteers to have "excellent" water quality.

Carlson suggests that people notice a change in transparency more easily than subtle changes in water quality and are more likely to favor management if they observe an adverse change in a lake's condition. When the condition of a lake is not changing, or is changing very slowly, people may not see the need for management despite the ambient condition of the lake.

Insight from the Dip-In leads Carlson to emphasize that water quality managers must be as concerned with perception as they are with substance. "If people do not perceive a problem — that is, if they accept existing water quality as normal, they may resist management efforts to improve it." (See *News-Notes*, #39, January / February 1995 for more information on the 1994 Great American Secchi Dip-In.)

[For more information on the 1994 and 1995 Great American Secchi Dip-Ins, contact Dr. Robert Carlson of the Department of Biological Sciences, Kent State University, Kent, Ohio 44242. Phone: (216) 672-3849 or (216) 672-3613; E-mail: rcarlson@phoenix.kent.edu]

---

## *Cleaning Up Orphan Sites — Toward an Economic, Market-based Approach to Abandoned Nonpoint Sources*

Most industrial sites including solid waste landfills and active mines are closely regulated. Permits that set operating and closure procedures are standard. But handling cleanups at abandoned sites is not so easy.

Even though "orphan," sites such as abandoned mine tailings, dewatered stream segments, and degraded habitat are often high priorities, the responsible party may have retired and moved away years ago. Individuals, corporations, or limited partnerships that have ceased to exist cannot always be identified and made financially liable for cleaning up watersheds adversely affected by orphaned sites. Yet sedimentation, turbidity, particulates and leachates from such abandoned sites are a large part of the nonpoint source pollution that continues to threaten the quality of water resources.

### *A Program Defined*

Now the Coors Brewing Company, in partnership with the U.S. Environmental Protection Agency and other stakeholders, is exploring the feasibility of an innovative, nonregulatory program to stimulate more effective clean up and prevention. The question being investigated is this: Is it possible for the federal or state government, or both, to offer some form of credit and relief from environmental liability to corporations, environmental groups, farmers, and others who voluntarily adopt such orphan sites?

The adopting party would work with the appropriate oversight agencies to remedy the pollutant flow; it would also receive "credits" for the work, based on water quality benefits achieved and stream miles benefited. Thus, market forces and private capital could be applied in the watershed, obviating the need for more taxes or subsidies. This solution also offers the possibility of integrating water quality and ecosystem management at the watershed level.

The feasibility of this approach is the subject of a pilot project in Colorado's Clear Creek watershed, one of 25 demonstration projects recognized by the National Forum on Nonpoint Source Pollution. In the Forum's report, *Water, Taking a New Tack on Nonpoint Water Pollution*, the orphan sites program is identified as "an innovative approach." It also demonstrates other forum principles, for example,

- industry can lead the nation in environmental stewardship,
- government can encourage voluntary initiatives,
- we should organize water management along watershed boundaries,
- we should ensure that programs are targeted where they are most needed,
- all stakeholders must have a voice in community water planning, and
- incentives can encourage land and water stewardship.

A variety of companies and individuals can be expected to get involved in the adoption process for the same reason that the Coors Brewing Company did, according to Scott Smith, the company's director of environmental health and safety policy and a chief architect of the plan. He said that Coors takes genuine pride and interest in the state, region, and watershed in which it is located and where many of its employees reside. It also shares the nation's vision and respect for clean water resources and, not least, wants to maintain a good corporate image. The adoption program will give other corporations and groups like Coors the incentive they need to become active along these lines.

### *Testing the Waters*

The Clear Creek watershed in Colorado is an appropriate site for the feasibility study for a number of reasons. The watershed is entirely in one state, which is convenient from an administrative point of view. It also has a number of major and minor orphaned sites and a large, well-educated stakeholder community.

A 50 by 10 mile watershed with lots of physical and geographic differences, Clear Creek's mountainous upper reaches were heavily mined. Its lower, agricultural plateau is becoming

heavily urbanized. Educational and voluntary activities are already being pursued. So far the Clear Creek Watershed Improvement Initiative has leveraged federal spending (largely from EPA and the USDA Forest Service) with \$20,000 to \$50,000 in matching corporate funds (from Coors) to do restorative work primarily in the upper watershed where most of the abandoned sites are found.

Four tasks are before the watershed's steering committee. The feasibility of credits for adoption depends on the program's ability to

- set clear goals,
- identify threats to the watershed (the affected sites),
- establish the value of potential "cures," and
- define exchange rates and ground rules for the use of the credits earned.

A further, overriding concern is how to ensure that the participating companies do not become saddled with Superfund-like liabilities for their efforts.

According to Smith, the Clear Creek program has already identified a steering committee and arranged for a coordinator/facilitator to manage the feasibility study. Members of the steering committee represent the key stakeholders — the environmental community (i.e., the Environmental Defense Fund), the chief regulators (i.e., Colorado's Water Quality Control Division, EPA), Coors, and representatives of the upper and lower watersheds.

Smith stresses that the goal of the Clear Creek project is strictly to determine whether the "credits for adoption" concept is feasible in practice. "Coors is certain," Smith said, "that a balanced stewardship is going to need all four of the principles currently at work in Clear Creek: education and information, voluntary incentives, regulatory impetus and compliance, and market-based approaches. We are also certain that if the idea works in Clear Creek, then it's a program that will also work in other watersheds."

*[For more information, contact Scott B. Smith, Director, Environmental Health and Safety Policy, Coors Brewing Company BC 395, Golden, CO 80401. Phone: (303) 277-2370; Fax: (303) 277-2463.]*

---

## *National Nonpoint Source Forum Recognizes Partnership Initiatives — TVA's Shoreline Management Initiative Shines*

Customer focus is a key management issue in the Tennessee Valley Authority's award-winning Shoreline Management Initiative. The program is one of four demonstration projects that the National Forum on Nonpoint Source Pollution recognizes as exemplifying the principle that "all stakeholders must have a voice in community water planning." The Forum believes that the effectiveness of these programs can be emulated by other communities in the nation's 52 major watersheds.

The Tennessee Valley Authority, created by Congress in 1933 to provide power and manage the resources within the Tennessee Valley, manages 250,000 acres of public lands, including 11,000 miles of shoreline — an expanse that could stretch from Tennessee to California and back two times.

### *Envisioning the Project*

The Shoreline Management Initiative began a little over a year ago to consider alternative shoreline management scenarios and to examine the economic and environmental impacts of residential shoreline development.

Alternatives being examined compare the effects of buffers and unobtrusive development along the waterfront with more intensive development, such as retaining walls, lawns down to the water, and large docks along the waterfront. The initiative addresses the effect of development on vegetation, wildlife, water quality, wetlands, cultural resources, aquatic habitat, scenic beauty, and public recreation opportunities. The ultimate objective is to establish a policy and decision-making framework that will define a long-range strategy for shoreline development.

"We want to determine an appropriate level of environmental protection for our shorelines," says Project Manager Tere McDonough, "but TVA's not a heavy regulatory agency. Our people don't wear guns or badges. We've always believed in using a pound of persuasion and an ounce of enforcement. So we are in a sense attempting to manage the future for the future — and the best way to do that is by being more responsive to customer issues and concerns."

The Shoreline Management Initiative has had extensive public and citizen involvement from the beginning, and TVA plans to continue that involvement as it moves forward. Before the project began, TVA and Auburn University asked Gallup to conduct a survey to get a concrete sense of what citizens want TVA to accomplish. A key finding was that 31 percent of those polled believe that TVA places top priority on the environment in the conduct of its public land stewardship, but 61 percent want to see a higher priority placed on the environment.

Although tremendous growth and development are occurring along the TVA reservoir system, TVA is in a good position to influence the future. Some 13 percent of TVA shoreline is now developed for residential use; about 5 percent has been developed for commercial, industrial, and public facilities; and about 10 percent is in a protected class as a wildlife refuge or a TVA-designated habitat protection area. Another 71 percent of the shoreline is now undeveloped.

The undeveloped area presents a broad range of opportunity. The initiative is studying the cumulative effects of various development scenarios — the effect, for example, of developing another 25 percent of the shoreline, or 50 percent, or 70 percent. Then, taking these projections separately, TVA can set targets for development to ensure that a reasonable blend of developed and undeveloped shoreline area is maintained.

### *The Initiative's Role in the Development Process*

Even before launching the Shoreline Management Initiative, TVA typically worked with individual lot owners in reviewing permits for development. However, TVA's involvement in one project raised a red flag about this approach.

A developer came to us, McDonough says, wanting to apply for various permits for each of several lots. He wanted a permit to dredge along the waterfront, to put riprap along the entire shoreline, and to build docks in front of each lot.

When TVA looked at the site conditions presented by the developer, it discovered that dredging wasn't needed, and that the properties were not eroding. A good stand of vegetation was flourishing along the shoreline and if left intact, no erosion problem would arise and riprap would not be needed. "TVA was able to show the developer some ways to save big money."

TVA also looked at the potential visual effect of placing individual docks along the shoreline, and found that if the docks were nestled in embayments, the whole development would be much more appealing. The agency also identified wetlands — some on TVA land, some on private property — and was able to negotiate with the developer to protect those wetlands. This project became the turning point. TVA saw that success was possible through negotiation and different approaches.

Through the Shoreline Management Initiative, TVA has moved beyond looking at individual lot-by-lot impacts to consider environmental impacts on a larger scale, the cumulative effect of development along the shoreline.

The initiative was launched by talking to the public — anybody who would talk to us was a welcome participant, McDonough recalls. Over 1,200 people in the Tennessee Valley attended 13 public meetings that were widely advertised through the media. TVA set up an 800-toll free information line to accept comments and developed a comment response form.

The meetings generated a tremendous volume of response — some 7,800 comments from over 200 people. TVA received many suggestions and ideas about changes it could make and a good sense of what people considered valuable and important. Essentially, they were keenly interested in protecting the scenic beauty of the lakes, and water quality was foremost on everyone's mind. People want clean water and have said so in every poll, McDonough noted.

The Shoreline Management Initiative also recognizes the importance of making sure that TVA actions do not infringe on private property rights. Property owners want to maintain their



access rights to the waters, and their right to have facilities along the waterfront. By the same token, many property owners think that TVA needs more comprehensive standards for shoreline development because such standards will help protect their investments and property.

Participants in TVA's public involvement activities also asked for education about how to better care for the shoreline environment. In response, TVA is considering developing an environmental handbook for property owners.

TVA is also assessing shoreline erosion conditions and attempting to characterize the shores as either mildly, moderately, severely, or critically eroded. This information can then be used to develop treatment plans for erosion control that move away from hard engineering approaches into bioengineering and vegetative treatment. It may be possible to develop a shoreline categorization system that will show the agency how such things as steepness of slope and erodibility of soils can be factored into development decisions to help protect sensitive areas.

Cost sharing is another possibility. TVA has historically taken a hands-off approach to funding erosion controls, but it is now exploring the use of cost-sharing incentives to encourage alternatives to riprap and retaining walls — and perhaps also for the establishment of buffers in areas where TVA doesn't own the property.

In addition, TVA is considering partnerships to acquire conservation easements. The agency is working cooperatively with farmers to put agricultural buffers along reservoirs and streams in the watershed, and cooperatively with marina owners to install boat pump-out systems that will reduce the volume of waste entering the water from boats.

### *Lessons Learned*

"One thing we've learned," says McDonough, "is that the customer focus pays off." Communications and education comprise a major element in solving nonpoint source pollution problems. Water quality problems are many and involve a range of ecosystems, but two things are certain. Science and public policy are not sufficient without the involvement of local communities and the participation of the businesses and residents who make their homes in the watershed. "You can't set policy in Washington, D.C., or in TVA's corporate towers and expect it to be implemented. You've got to get local people involved to hammer away at these problems."

The other lesson is that quick short-term fixes are not the solution. Science, public policy, and the participation of all stakeholders is needed if we really want to make changes over the long haul. That is the perspective of the Shoreline Management Initiative, and it has been quite successful. TVA hopes to share its information with others and to learn from others as it takes this initiative into the future.

*[For more information, contact Tere McDonough, Land Policy Specialist, Reservoir Land Management, Tennessee Valley Authority, 17 Ridgeway Road, Norris, TN 37828. Phone: (615) 632-1542; Fax: (615) 632-1534.]*

---

## **Urban Runoff Notes**

### *Preventing Urban Sprawl Requires New Models for Community Development*

Located in the small coastal town of Shallotte, North Carolina, 35 miles south of Wilmington and eight miles from the ocean, in an area of low topography that has wetlands everywhere, a new development is taking shape. Under the umbrella of sustainability and the "New Urbanism," the village of Woodsong in South Brunswick County will contain 160 dwellings, including a facility for assisted living for the elderly. A golf course is nearby, and a school is only a seven-minute walk from the neighborhood.

Developer Buddy Milliken and his partners, Waburn and Betty Walton, envision the village, which will begin on a 22-acre tract, as an alternative to the usual suburban development. "It's something we've been planning since mid-1992," Milliken said, "starting from the concept of a residential community that will be environmentally sensitive, economically viable, and amenable to community and social values."

The project received final approval from the town of Shallotte in October, and the developers will soon apply for erosion control and stormwater permits. The groundbreaking is planned for spring 1996. "If we do a good job," Milliken says, "then we think the village is ideally located to serve as a model for other builders."

The challenge of creating a compact, high density neighborhood was compounded for Milliken by the site conditions. Woodsong will be built on moist upland and sandy coastal plain sediments that grade into an adjacent forested wetland. And though it is clear that the development will modify, even reshape, the landscape, Milliken has put together a partnership of designers and professionals who are intent on respecting the natural processes already in place.

The existing landscape consists of pine flatwoods and an adjacent wetland that was likely evergreen shrub or Pocosin before it became a pine forest, both typical habitats of southeastern North Carolina. The development will maintain the wetland for wildlife habitat, for water quality enhancement, and for recreational and educational uses. "Sensitively constructed boardwalks through the wetlands will ensure that it also functions as part of the human habitat," Milliken said. "As such, it will provide a contrast to the intensity of the neighborhood's constructed part."

### *Wetlands Protection — A Priority*

C. Halford House, a wetlands ecologist at North Carolina State University, is one of many specialists helping Milliken design the neighborhood. An important question concerns the approximately one-acre wetland that will be affected by the plan. Milliken has been asked to explain how he thinks he can build on this site without causing or accelerating the destruction of the wetland. "We tried to answer that question up front," Milliken says, "and clearly we can't avoid affecting the wetland, but we propose to restore it, not destroy it."

The wetland is not, he added, "an undisturbed natural wetland, or even one of high overall quality." Prior to his involvement with the land, a fairly straight, steep ditch was dug in the heart of the wetland for drainage. Says Milliken:

*We propose to restore some of the hydrology that was here before the ditch was dug. Gabians will be used in the ditch to slow the flow of water and allow natural filtering to occur through a series of pools and planted areas. We are also striving to preserve and create the seeps that are necessary habitat for the area's native insectivorous plants, such as venus fly-traps and pitcher plants.*

*We want to improve the functional capabilities of the wetland and increase biodiversity and quantity. Intervening in a natural system and supposedly "enhancing" it to support development is tricky business, but mere isolation does not seem to be the answer either. We will take the lightest touch possible to ensure the development's contribution to regional ecosystem health and its site-specific constraints.*

Controversy is a fact, and melding the environmental, social, and economic goals will take stamina. Milliken acknowledges that some people view the current regulatory process, which doesn't require permits on wetlands of one acre or less, as a formula for "orderly destruction." But he says that he is building within the city precisely to channel developments within urban boundaries and to preserve rural landscapes.

### *A New Kind of Development*

What makes the development different is that it is intentionally planned as a high density residential development dependent on pedestrian traffic. "One of the central tenets of the new urbanism model is that the street ought to be experienced as an outdoor room," Milliken said. "Everything will be located within a five minute walking radius of the neighborhood plaza, assuming that these 22 acres are the first quadrant in an idealized five-minute-walk neighborhood of between 80 and 140 acres."

The community will not be totally self-sustaining, but with services compactly arranged, transit supporting densities, and pleasant walking and bicycling routes, residents should have less automobile dependency.

## Stormwater Management Techniques

Milliken says that when you consider the huge amount of infrastructure and especially the highways that are needed for traditional, low density development, its environmental costs are likely to increase. That's what usually happens in typical subdivisions in Milliken's locality: they grow so rapidly that stormwater is channelized and flash flooding becomes a difficult problem.

Milliken says that the hydrologic flow in the area will be affected by the development. High density building entails a lot of rooftops in a compact area. Still, he says, the evidence is convincing that "on a regional watershed basis, clustered development produces fewer water quality problems than conventional low density development given constant densities and land area." The challenge is to deal intelligently with the concentration of impervious surface in the developed area.

The prevalence of wetlands in South Carolina and the relatively high water tables typical of the coast also compound the runoff problem, but the development will maintain water quality by using a wide array of stormwater management techniques, including a mix of preventive and control measures.

- Stormwater controls will begin at the house where each homeowner will be required to provide a plan to minimize runoff. Some practices include cistern collections, diversion to shallow infiltration basins, planting species near overhangs that have a high capacity for water storage, and using perforated drainage pipes or drain trenches that allow infiltration during high flows. Residents will be encouraged to use gardening and other landscaping techniques such as planting native species that require less irrigation and fertilizer.

- At the street level, shallow aggregate-filled tree pits will be used to slowly infiltrate most of the excess runoff. The tree pits are spaced every 30 feet along both sides of the road and have significant storage capacity. The street is designed to be slightly inverted with catch basins and underground pipe in the center of the street. Milliken says that the inverted street will help create an almost-level grass slope to serve as on-street parking.

"This approach eliminates the need for 16 feet of paved parking surface — eight feet on each side — and 10 feet of sidewalk," Milliken says, "but it also eliminates the use of grass swales, since swales would obviously impair the use of the street margins for parking or walking." Without swales, however, Milliken must find another way to treat the street runoff before it reaches the detention pond. Although this problem is still being worked on, Milliken does not believe that increasing the paved area to gain grassy swales is "the way to go at this time."

- Before the piped runoff reaches the detention pond, a level spreader trench will slow and treat it. The edge of the pond will have a vegetated transition for additional treatment. Afterwards, the water will flow into the restored wetland and follow a serpentine path through wetland vegetation before leaving the site.

The goal of the combined stormwater controls is to minimize, disperse, retard, and treat the runoff through natural plant processes. However, the development is still in the design stage, Milliken says, and any arrangements that do not prove feasible will be altered.

Further, the entire neighborhood will continue to conduct base-line tests of the water budget to the wetland and to monitor the impacts of development. Those involved in the community's design note that once the stormwater controls are sufficient, similar careful planning, experimentation, and community participation will be needed to deal with additional resource issues.

By clustering the development, the community frees land for wildlife habitat, forests, and agricultural production that in other developments has to be used to bolster the extension of support services and infrastructure. "Ideally," Milliken concludes, "we hope to achieve an optimal mix of built and unbuilt area that will provide humans a place to live while simultaneously responding to the carrying capacity of the natural environment."

*[For more information, contact Buddy Milliken, The Milliken Company, 16 South Front Street, Wilmington, NC 28401. Phone: (910) 763-7991. Or C. Halford House, Wetlands Ecologist, North Carolina State University, P.O. Box 8008, 3118 Jordan Hall, Raleigh, NC 27695-8008. Phone: (919) 515-3674.]*

---

## Urban Runoff Controls

### *Please the Senses and the Pocketbook*

At the Hyatt Regency Ravina Hotel in Atlanta, Georgia, a series of ponds linked by streams and waterfalls provides an aesthetic refuge for the hotel's guests. Homeowners in Boulder, Colorado's Sale Lake subdivision enjoy a tranquil setting surrounding a four-acre wetland, a benefit they paid as much as 30 percent extra to obtain. People have long appreciated the aesthetic qualities of natural waterbodies, so it is no surprise that these beautiful landscapes attract customers and home buyers. The difference at the Hyatt Regency, Sale Lake, and a growing number of developments across the country is that these ponds and wetlands were not sculpted by nature, but by humans, and are specifically designed to collect and cleanse stormwater runoff.

A new report by EPA's Office of Wetlands, Oceans, and Watersheds documents how aesthetically designed stormwater runoff controls can satisfy the desire for waterfront acreage and economically benefit both developers and property owners. The report, *Economic Benefits of Runoff Controls*, contains examples of new and existing residential and commercial properties whose proximity to an aesthetically landscaped wet pond or constructed wetland adds an estimated \$6,000 to \$60,000 to their base value.

*Economic Benefits* explores the factors that lead to increases in property values, including landscaping, the location of an artificial pond or constructed wetland, and associated recreational facilities like picnic areas and walking trails. It also examines factors that lead to decreases in property value, such as potential safety problems, and illustrates how some developers offset these potentially negative aspects.

This 16-page report was written to be read and understood by developers and local decision makers. A short glossary of terms enhances the reader's understanding of technical processes. A chart of real estate premiums charged for property fronting urban runoff controls speaks for itself. So do the words of one developer: "We are required to build urban runoff management basins. Why not take an environmental negative and turn it into a positive visual asset?"

*[To order free copies of Economic Benefits of Runoff Controls (EPA 841-S-95-002, September 1995), contact the National Center for Environmental Publications and Information. Phone: (513) 489-8190.]*

---

## South Carolina Land Development Stewardship Award

In South Carolina, award winning "stewardship developments" abound, including the Isle of Palms Connector, a commercial development project; the West Ashley Bikeway in Charleston County; and residential developments like Spring Island in Beaufort County and Dewees Island in Charleston County. Each one proudly displays a sign recognizing its environmental achievement.

According to Chip Berry of the South Carolina Department of Natural Resources (DNR), "These projects and their teams show us that with vision and proper planning, we can have growth and development simultaneously with natural resource protection and enhancement."

The DNR Land Resources and Conservation Division created the award program in 1993 to recognize projects that protect, conserve, and improve natural resources. This year, the program will include recognition for developments that emphasize habitat protection and improvement; water quality protection; greenspace protection; scenic, historical, archaeological, and cultural protection; and environmental compatibility of site selection and plan.

To retain their stewardship development status, developers submit a long-term resource management plan for each project, and DNR periodically checks to make sure that they continue to follow their management plans.

"The stewardship development signs are a magnet for the public and may well mean profit for some developments," Berry said. "In addition to recognizing those planners and developers who are doing an exemplary job of natural resource conservation and protection, the program helps others to see how natural resources can be protected and enhanced with thoughtful and innovative land development techniques."

*[For more information, contact Chip Berry, DNR Division of Land Resources and Conservation Districts, 2221 Devine Street, Suite 222, Columbia, SC 29205. Phone: (803) 734-9100.]*

---

## Buffalograss — An Alternative to Thirsty Turf

Adapted from *The Aquifer* 9(2), September 1994, courtesy of the Groundwater Foundation.

The turfgrass of the future will be a dream for caretakers and environmentalists. The grass will grow slowly, requiring little back-breaking mowing; it will be hardy, needing only minimum irrigation and chemicals; and it will look good: lush and blue-green. In short, this turfgrass will be good for the earth and require less fuss and cost for those who have to maintain it.

For such turfgrass, the future is now, thanks to a University of Nebraska at Lincoln (UNL) buffalograss adaptation project. Buffalograss varieties developed by the project are already being sold commercially with considerable success. They include buffalograss 609, a southern variety; and two northern varieties, 315 and 378.

### *Buffalograss Adaptiveness*

Buffalograss, a warm-season grass of the Great Plains of North America, has until now been used primarily for livestock forage, according to Professor of Horticulture Terry Riordan, a long-time participant in the UNL buffalograss project. Research and development was needed to adapt it for turfgrass uses. Hoping to develop low-maintenance grasses, the U.S. Golf Association provided funding for UNL's research, and Crenshaw & Doguet Turfgrass of Austin, Texas, helped commercialize the product and is now the major marketer of the grasses. Turf producer David Doguet and professional golfer Ben Crenshaw established Crenshaw & Doguet Turfgrass specifically to market grasses that are better for the environment. "We're going to have to live with less water. That's a given," Crenshaw explained.

Crenshaw & Doguet Turfgrass bought the rights to UNL's first release, 609 Buffalograss, a variety adapted for the southern United States that UNL officials say has many desirable turfgrass characteristics: low growth; high stand density; fine blades; blue-green color; tolerance for drought, cold, and heat; resistance to most turfgrass insects and diseases; and minimal irrigation, fertilization, and pesticide requirements.

The first sales of the 609 variety were made in late 1991. UNL officials say the variety has performed well from a horticultural standpoint, and Doguet says that it has been in high demand. The grass has many uses — lawns, golf courses, roadsides, erosion control, parks, and cemeteries. The first two northern varieties 315 and 378, which should have the same usefulness, are now available from Nebraska growers.

According to Riordan, varieties 609, 315, and 378 are female grasses that reproduce vegetatively. Vegetative varieties can be grown in sod or plugs, but not from seed. But UNL has engaged in a major effort to develop seeded buffalograss varieties as well, and the first seeded variety, "Cody," is now available.

From 1984 to 1992, UNL received \$250,000 from the U.S. Golf Association for buffalograss research, and the association has made a new grant of \$310,000 to continue the research for another five years. "Over the five years of this new grant [1993 through 1997], there should be major improvements in the buffalograsses that are available in the marketplace," Riordan said.

### *Buffalograss Does More for Less*

How much work and expense does buffalograss require for maintenance? Not much. Riordan said buffalograss can be mowed weekly, monthly, or once a year, depending on preference. "With bluegrass, you don't have that flexibility," Riordan noted. Mowing is also made easier by the fact that buffalograss clippings can be left to decompose. In addition, buffalograsses require fewer chemical inputs. They should be fertilized once or twice a year. Once established and properly maintained, weed pressure in buffalograss — and the need for pesticides — is minimal.

Buffalograss uses significantly less water than common turfgrasses, such as Bermuda, St. Augustine, and Kentucky bluegrass, according to the Texas Water Commission. In Nebraska, buffalograss needs 1 to 1.5 inches of water per month compared to 1.5 inches per week for bluegrass, Riordan said.

Buffalograss —  
An Alternative to  
Thirsty Turf  
(continued)

But will golfers recognize the switch? "With a little maintenance in this part of the country, we can get buffalograss pretty comparable to bluegrass; however, as a warm-season species, buffalograss greens up later and goes dormant earlier than cool season species such as bluegrass," Riordan says.

UNL's work on buffalograss has expanded the number of choices for consumers. Riordan isn't advocating that people rip out their existing turfgrass and replace it with buffalograss. But he does believe that a good market for buffalograss exists in new installations, especially in locations with water shortages.

[For more information, contact Terry Riordan, University of Nebraska, 377 Plant Science Building, Lincoln, NE 68583-0724. Phone: (402) 472-1142.]

---

## What's It Worth?

### Study Links Property Value to Water Quality

By Roy Bouchard, *Maine Department of Environmental Protection*. Adapted from *Nonpoint Source Times*, a newsletter published by the Maine DEP.

Lake managers often argue that local economies depend on the value of the recreational opportunities associated with high quality public waters. Lakefront property owners generally agree, but other local residents and town officials may be a less receptive audience. Hard evidence of declining values in lakefront property as a result of degrading water quality and a subsequent increase in the entire town's tax burden may be the missing link in getting their attention.

The University of Maine at Orono (UMO) has recently completed a study entitled "Hedonic Property Value Study of Water Quality in Maine Lakes." The study, based on the minimum seasonal lake water clarity during the study period, examines the relationship between water clarity and the selling price of more than 900 shorefront properties on 34 lakes divided into six market areas across Maine between 1990 and 1994. After controlling for the effects of property attributes, including lot size, neighborhood characteristics, and house size, the results clearly illustrate that water clarity is strongly related to the price people are willing to pay for property. Simply put, within a group of lakes of varying water quality, properties on lakes with lower water clarities have lower property values. The models show that a one-meter difference in average minimum clarity over 10 years was associated with property value declines of \$3,000 to \$9,000 (up to 22 percent). Shorter term reductions in water quality result in smaller, but still significant drops in property value.

The economic losses related to culturally induced eutrophication are hard to quantify. With respect to property values, we can approximate the loss statewide by examining the number of lakes with below average clarity. By one conservative estimate, the total value lost on these lakes ranges from \$252 to \$442 million. If lakes with a minimum clarity of below two meters (79 lakes) are considered sufficiently impaired to show the model effects, then a \$119 to \$209 million loss has already occurred.

The value of protecting good quality lakes now becomes more obvious. In the town of Belgrade, for example, a one-meter reduction in the average summer clarity in area lakes could result in a loss of \$13.2 to \$30.5 million. This shortfall could cause an increase of 10 percent in the tax burden of off-shore property owners.

Clearly, then, everyone pays a real price if water quality deteriorates from lack of awareness and protection. Maine Department of Environmental Protection has begun two new studies with UMO: one to deal with the dollar value individuals place on water quality in lakes; the other to estimate the local economic impact of lake usage.

**EDITOR'S NOTE:** Although the above figures are preliminary, the author informs us that numbers in the final report support the validity of the conclusion.

[For more information, contact Roy Bouchard, Maine DEP, Land and Water Bureau, State House 17, Augusta ME 04333. Phone: (207) 287-3901.]

---

# Notes on the Agricultural Environment

---

## *Lagoon Failures Spotlight a Need for Vigilance*

Unusual rainfall from the end of May through June contributed to several animal waste lagoon failures in North Carolina, but improper operation or inadequate maintenance of the structures were contributing factors, say investigators, followed by design and planning problems associated with some of the older lagoons.

The failures represent a small fraction of the more than 4,000 animal waste control structures in the state. Even so, the spills are significant in their potential adverse effects on water quality. Studies of all the state's waste ponds and lagoons by the Natural Resources Conservation Service (NRCS), Soil and Water Conservation Districts (SWCD), and the North Carolina Division of Environmental Management (DEM) have revealed 520 structures with problems — 124 at a critical level.

According to Andy Smith, public affairs coordinator with the North Carolina NRCS, spring rains exceeding the 100-year storm frequency, and even the 500-year frequency in some areas of the state, are linked to the overtopping of four of the failed lagoons. Lagoons built to NRCS standards are designed to withstand a 25-year, 24-hour storm and to provide an extra margin of safety. Most areas of the state did not experience rain events in excess of this level, which in North Carolina is five to eight inches of rain in 24 hours.

David Holsinger, nonpoint source technical coordinator with the North Carolina DEM, contends that "an NRCS-designed lagoon should not be a problem even in a 100-year storm if properly managed." But, adds Smith, "what the farmer does after the lagoon is designed and constructed also makes a difference." Maintenance includes preserving diversion channels that capture and divert surface water, monitoring effluent levels, and preventing erosion.

Holsinger noted that the severe rains were preceded by several months of drought and that taking proper action at the right time could have averted most of the failures. He said that when rain events exceed the design limits of the lagoon, farmers can discharge effluent without the threat of a notice of violation.

### *Lagoon Failure Releases 22 Million Gallons of Effluent*

The largest lagoon failure occurred at Oceanview Farm, a corporate hog finishing venture in Onslow County, North Carolina. DEM engineering inspections determined that the breach at Oceanview resulted from a combination of improper operation and maintenance procedures. Not only had the placement of an irrigation pipe on one of the lagoon's embankments weakened the structure; the lagoon's capacity had also been exceeded prior to the rains. According to Holsinger, Oceanview needed twice the cropland available for spreading effluent to maintain the lagoon at its intended capacity.

Oceanview received a notice of violation from North Carolina DEM and an enforcement action that called for \$110,000 in fines for environmental damages and to reimburse investigative costs. Violations ranged from not having a plan to not reporting the spill. A court order required Oceanview to cut its operation to 40 percent of its current capacity, corresponding to the amount of land available for land application at the time of the lagoon breach.

### *In the Aftermath*

Following the North Carolina lagoon failures, Governor Jim Hunt called for inspection of all animal waste ponds and lagoons. The General Assembly allocated \$1.5 million to the North Carolina DEM for routine inspections of livestock waste management systems and provided funding for SWCDs to supply technical assistance to farmers.

In addition, the Assembly passed two bills that help address the lagoon problem, at least in swine production.

- The Structure Setback and Buffer Rule requires that swine waste structures be located 1,500 feet from a residence not owned by the farmer; 2,500 feet from a place of public assembly; and 100 feet from any property boundary.
- Swine operators must attend a six-hour animal waste structure operation and maintenance training course and complete a certification exam to become a certified operator. Certification is limited to a five-year term.

Governor Hunt also appointed a study commission on agricultural waste consisting of 18 people representing the agriculture industry, water quality agencies, industry, law, academia, and the environment to address the lagoon failures. Commenting on these initiatives, Walter Cherry, executive director of the North Carolina Pork Producer's Association, says "We support the legislative action and the Governor's efforts to provide additional technical assistance to our farmers. We recommend that DEM conduct routine inspections of all animal waste management facilities in the state at least twice a year."

Lagoons have only recently become subject to regulation. In the past, some North Carolina lagoons consisted of little more than excavations or earthen pits built without plan or design. The state passed new nondischarge rules in 1993 requiring existing livestock operations to obtain operation and maintenance plans for their lagoons by 1997. New operations must develop a plan and undergo design review and construction inspection of their lagoons before they are allowed to stock animals. Holsinger said that although Oceanview had completed these precautionary steps, modifications made to the structure following its inspection and flawed operations resulted in the failure. "Unfortunately," he concluded, "Oceanview did not achieve 100 percent compliance."

In addition to North Carolina's efforts to address the lagoon problems revealed by these events, the NRCS has convened a National Engineering Consequence Team to investigate the lagoon failures that occurred in several states in connection with the unusually wet weather.

North Carolina is responding quickly to lessons learned from the lagoon failures, and all is not doom and gloom, as Smith points out. "Although faced with the same rainfall, a lot of farmers do maintain and operate their lagoons properly, and they didn't fail."

*[For more information contact David Harding, NPS Coordinator, North Carolina Division of Environmental Management, P.O. Box 29535, Raleigh, NC 27626. Phone: (919) 733-5083 ext. 569. Fax: (919) 715-5637. Or contact Andy Smith, Public Affairs Coordinator, Natural Resources Conservation Service, 4405 Bland Road, Suite 205, Raleigh, NC 27609. Phone: (919) 790-2884. Fax: (919) 790-2881.]*

---

## Network Pursues Comprehensive Farm Planning in Great Lakes Basin

Sustainable agriculture and environmental organizations have created a network that crosses state and international boundaries and extends comprehensive farm planning across the entire Great Lakes drainage basin.

Loni Kemp, a policy analyst for the Minnesota Project, which provided leadership and coordination to organize the network, explains that the network capitalizes on the value of comprehensive farm planning to "consider profitability and the environment simultaneously." *The Great Lakes Basin Comprehensive Planning Network* describes four comprehensive farm planning tasks:

1. taking an inventory of farm resources, such as soils;
2. setting goals for production, profitability, pollution prevention, and ecosystem enhancement;
3. analyzing management options within the context of regulatory program requirements; and
4. developing a strategy to implement the plan and to evaluate its success.

The Great Lakes Protection Fund, a nonprofit environmental organization, provided a one-year planning grant to form the network, with representatives from the local steering committee of each Great Lakes state and the Canadian province of Ontario.

The Great Lakes Protection Fund has allocated an additional \$356,000 for two more years. The allocation is divided among network members and combined with matching funds raised locally to support Comprehensive Farm Planning in each jurisdiction. Kemp foresees that the network will "serve as an incubator of the different approaches," allowing jurisdictions to share their successes and failures to develop a common approach to Comprehensive Farm Planning at the basin level.

*[For a free brochure on the Great Lakes Basin Comprehensive Planning Network, contact the Minnesota Project, 1885 University Avenue West, Suite 315, St. Paul, MN 55104-3403. Phone: (612) 645-6159.]*



---

## *TVA and Ag Retailers Working to Prevent Pollution at Chemical Mixing Sites*

More than 65 retailers of agricultural chemicals in 27 states are investing an average of \$175,000 each in containment structures to prevent nutrients and pesticides from entering surface and groundwater. In a program organized by the TVA Environmental Research Center at Muscle Shoals, Alabama, the retailers are introducing voluntary pollution prevention safeguards at fertilizer and chemical mixing sites across the nation.

TVA's pollution prevention techniques include dikes and berms around product storage tanks, concrete loading pads, noncorrosive coatings for concrete structures, stormwater control structures, and improved monitoring techniques.

"We are promoting ways of working with dealers, and through them, with farmers," said Ron Williams, manager of land and water sciences for TVA. "Our objective is to protect the farm community's productivity and profitability while improving water quality."

*[If you are a dealer or know dealers interested in these prevention techniques, contact Ronald J. Williams, Acting Vice President, TVA Environmental Research Center, P.O. Box 1010, Muscle Shoals, AL 35660. Phone: (205) 386-2860.]*

---

## **News from the States, Tribes, and Localities, Where the Action Is**

### *Missouri Forage and Grassland Management Project Works for Water Quality Protection*

A 23-county area in southcentral and southwest Missouri has the highest concentration of beef and dairy cattle in the state. The area's five recreational lakes and several scenic rivers provide a base for tourism and residential development in the area. This potentially uneasy mix of land uses works largely because a successful grazing demonstration project helps protect recreational waters and increase profitability in the forage and livestock enterprises.

A 10-member committee representing farmers, ranchers, the agriculture industry, Soil and Water Conservation Districts, Cooperative Extension, and Natural Resources Conservation Service (NRCS) personnel provided direction for the project. Two Resource Conservation and Development councils, the Missouri Department of Natural Resources, the NRCS, and a U.S. EPA 205(j)(5) grant funded a grasslands specialist to implement the project.

#### *Grazing Systems Prove Profitable*

The Top of the Ozarks and the Southwest Missouri Resource Conservation and Development councils conducted the Forage and Grassland Improvement Demonstration Project from mid-1992 to 1995 to help producers design, implement, and maintain grazing and watering systems and pasture establishment measures, in place of conventional silage feed production and feed lots. In the rotational grazing system used for the project, livestock were allowed to graze a section of pasture for one to three days before moving on to the next section. Each section rested 20 to 40 days between grazings.

The grazing systems reduced erosion, limited livestock impacts on streams, and provided higher quality diets for improved livestock performance. Mark Kennedy, the project's grassland specialist explains, "From an animal standpoint, management intensive grazing ensures that plants are in a high state of nutrition when livestock graze. From a plant standpoint, it provides respite, and from an environmental standpoint, it more evenly distributes manure over the grazing area. It ties the animal needs to the plant needs."

The farms ranged in size from 40 to 4,000 acres. Kennedy tested soils on the farms, and helped producers maintain a satisfactory plant fertility level through nutrient recycling (i.e., from improved manure distribution). This step also eliminated the need for supplemental fertilizer. In addition, grazing livestock "harvested" weeds such as ragweed and lambs quarters, eliminating the need for herbicides.

### Projects Demonstrate Self-Sufficiency

In an unusual twist to the project, farmers who implemented the grazing systems did not receive cost-share. Kennedy explains that the cash-flow benefits of the systems were their selling point. "It would have defeated the purpose of the demonstration project if other farmers who wanted to apply the grazing systems could not obtain cost-share." In 1994, however, the Missouri Department of Natural Resources recognized the benefits of grazing systems and initiated a pilot cost-share program for three counties. This year, the cost-share program was extended to nine counties, and it is scheduled to go statewide in 1996. The program is administered by local conservation districts.

As early as its first year, the project revealed a high rate of return for demonstration farm producers:

- Over a 290-day period, one operation using rotational grazing produced 733.38 pounds of beef per acre and 1.02 tons of hay per acre compared to conventional yields of 150 to 350 pounds of beef per acre. In addition, plant fertility levels remained high without commercial fertilizer or herbicide for five years.
- At a dairy operation, income over feed cost increased from a low of \$3.31 per hundred weight (cwt) of livestock using a conventional feeding system to a high of \$5.61 per cwt using a grazing system — a 59 percent increase in income. The cost of the water and fencing used in the grazing system was \$61 per acre, or \$3,908; however, the cost-saving in feed was \$234 per cow for a herd of 55 cows, or \$12,870.

The dairy farmer also reported that the grazing system was less labor intensive than conventional systems, greatly reducing the time demanded for harvesting forage and managing manure.

Kennedy reports that rotational grazing systems limit livestock access to streams to short periods of time, improving streambank conditions in comparison to those in pastures grazed full-time. "Although even limited access is not ultimately desirable for the stream, it is preferable to perpetual access, and limits the intrusion of nonforage plant species into the grazing system," Kennedy explains. A water quality monitoring project on the Upper Niangua is monitoring the impacts of no stream access, limited-access, and full-access grazing systems.

### Outreach Effort a Success

In connection with this project, the Resource Conservation and Development Councils have published and distributed 8,000 copies of a "Pasture Management Guide for the Ozarks" and created a display to showcase the management measures used by the demonstration farms at agricultural events. They also mailed a monthly calendar of events to agency personnel and interested farmers that tracked the progress of the demonstration projects, hosted conferences, and coordinated field days at demonstration farms.

Missouri farmers are showing interest in management intensive grazing. The University of Missouri and the NRCS offered Management Intensive Grazing Schools across the state this year with 40 to 60 farmers attending each school. The demonstration project offers convincing evidence that changing livestock systems to reduce inputs in favor of increased management results in positive water quality and cost benefits — a change that Kennedy says, "replaces horsepower with brain power."

*[For more information, contact Mark Kennedy, State Grassland Specialist, Top of the Ozarks RC&D, 1437A South Highway 63, Houston, MO 65483. Phone: (417) 967-4188. Fax: (417) 967-5283.]*

---

## Success Stories from the City's Edge — Suburban Ranchers in the Southwest Reduce Nonpoint Source Pollution

Casinos aren't the only source of good fortune for Nevada residents this year. Small ranchers in the state are also profiting from participation in the Suburban Agricultural Nonpoint Source Educational Program sponsored by the University of Nevada Cooperative Extension and funded through a 319(h) Nonpoint Source Program grant from the Environmental Protection Agency.

Targeted to small ranches in suburban Reno, the program began as a series of workshops to help property owners plan strategies to keep pollution out of the Truckee River, which provides

drinking water for the cities of Sparks and Reno and spawning habitat for the threatened Lahontan cutthroat trout and endangered Cui-ui fish. The same program also protects Nevada's groundwater.

The program began in the Dry Creek watershed which drains into Steamboat Creek, a tributary of the Truckee. A series of ditches pass water from one ranch to the next where livestock graze in pastures or are held in paddocks or corrals. Coordinated and administered by Extension Water Resource Specialist John Cobourn and Extension Water Quality Specialist Susan Donaldson, the program has achieved some notable successes in improving water quality through revised land treatment.

### *Exotic Animals*

A small ranch that houses emus, llamas, Scottish highland cattle, and Texas longhorns sought help from the program. The owners, recognizing that the operation strains the carrying capacity of the 10-acre plot, wanted to protect the land from wind and stormwater erosion.

The Natural Resources Conservation Service and the University of Nevada Cooperative Extension recommended confining some of the animals to one section of the pasture and moving the others to rented space for a year to allow reseeding and reestablishment of the pasture. When the animals return, the pasture will be fenced to promote rotational grazing. The benefits of the new system are many: it avoids overgrazing, erosion, and damage to the water supply.

### *No Experience Necessary*

In another case, an inexperienced owner moved onto a run-down, weed-infested 2.5 acre property without knowing how to improve the pasture. Workshop participants and technical advisors helped solve the immediate problem by suggesting that the owner reroute the irrigation water for more even distribution and control weeds by mowing during the dry summer months when no irrigation water is on the ground.

When soil analysis revealed a severe lack of nitrogen on the same site, the program also recommended — and the owner hired — an experienced operator to disk the fields, apply fertilizer according to soil test results, and drill an appropriate pasture seed mixture into the fields. The owners plan to keep livestock off the pasture for at least a year.

"The Truckee River is so far away," confided the owner, "that before I became involved in the Small Ranch Program, I never realized that what I do on my property — how I manage my pasture — can affect water quality all along the river."

### *Neighbors Helping Neighbors*

This same volunteer mobilized a neighbor to solve an irrigation problem that was leaching nutrients and organic matter from manure deposited in a horse paddock.

During flood irrigation, the neighbor's irrigation water soaked the corral area and runoff carried the pollutants next door. The neighbors worked together to reroute the water flow. They

## Portrait of the Suburban Agricultural Program

- **How It Works.** Each winter participants of the Suburban Agricultural Nonpoint Source Educational Workshop attend two-hour classes for nine consecutive weeks, culminating in the design and implementation of BMPs that will be used on their properties and demonstrated to other volunteers. During each workshop, appropriate BMPs are explained and suggestions for implementation are detailed. Experts in agriculture, horticulture, livestock management and hydrology lead the workshops. The ranchers' knowledge is measured using a pre-and-post test; the volunteers' mean scores often improve by as much as 36 to 86 percent.
- **Additional Resources.** About 450 ranches in the watershed receive a monthly newsletter that includes an educational column, a "BMP of the Month," and news about program events. An 80-page manual, written for a general audience, has also been produced to provide guidance on pasture management; irrigation; water management; protecting creeks, ponds and wet areas; principles and techniques of erosion control; animal waste composting; septic system and well maintenance; integrated pest management; and water-efficient residential landscaping.

[For more information, contact Susan Donaldson, Program Water Quality Education Coordinator, University of Nevada Cooperative Extension, P.O. Box 11130, Reno, NV 89520-2893. Phone: (702) 784-4848]

circumvented the corral by digging ditches around its perimeter. The result was cleaner, better smelling water and a healthier habitat for the horses.

Such cooperation is a hallmark of the program. One of this summer's workshops was actually a work party. Participants came with gloves, work clothes, and shovels to help a property owner build two compost bins to recycle horse manure. The bins were placed in a dry corner of the pasture adjacent to the barn to avoid possible water contamination.

### *Evaluating the Program*

The overall success of this program is evidenced by the ranchers' participation. As many as 75 residents have attended events sponsored by the program and survey results also give high marks to the usefulness of individual program components. On a scale from 1 (not at all useful) to 5 (extremely useful), the overall average rating was 4.4.

Participants also recognize the value of the program to each individual. Improvements increase ranch productivity, property values, and the appearance of the ranches. Participants can also take pride in their efforts to decrease regional nonpoint source water pollution.

Local representatives of the Washoe County Department of Comprehensive Planning, the Washoe Storey Conservation District, and the USDA Natural Resources Conservation Service helped Extension design this project and are pleased with its success. They expect the program to spread to other areas of the Truckee River watershed.

*[For more information, contact Susan Donaldson, Program Water Quality Education Coordinator, University of Nevada Cooperative Extension, P.O. Box 11130, Reno, NV 89520-2893. Phone: (702) 784-4848]*

---

## **Technical Notes**

### *Lower Tire Pressure Reduces Sediment from Logging Roads*

by Tom Moore and Larry Cronenwett

Forest Service studies conducted over the last five years indicate that lowering tire pressure on heavy-haul vehicles can dramatically reduce erosion from logging roads. The most dramatic reductions are on unsurfaced roads or on aggregate surfaces that produce a high degree of fine material during hauling operations.

Research conducted in Lowell, Oregon, showed that reducing tire pressures on heavy-haul vehicles reduced road surface sediment loads an average of 80 percent over a three-year test period. The test was conducted on a forest road with an aggregate surface. In one test year, researchers noted an 84 percent reduction in sediment levels.

Tire pressures were lowered from highway pressures of 90 pounds per square inch (psi) to 30 pounds psi in the drive tires on empty trucks, and to 50 pounds psi in the drive and trailer tires on fully loaded trucks. Speeds were restricted to under 35 mph.

This research has major implications for roads in national forests, and other forested areas in watersheds seeking higher water quality standards. For example, the recently published standards and guidelines amending National Forest Plans in the Columbia River Basin impose stringent measures to reduce sediment levels. These new standards and guidelines will help protect and improve vital spawning habitat for dwindling supplies of native Coho and Chinook salmon.

The Boise National Forest recently sold 12 million board feet of timber subject to reduced tire pressure on log truck and heavy truck traffic. The pressure regulation is needed to reduce sediment transport into streamcourses and protect the resident bull trout population.

Automated Central Tire Inflation (CTI) systems have been developed to raise and lower tire pressures even while a heavy-haul vehicle is in motion. The Forest Service is interested in using CTI systems for hauling National Forest products, and several private timber corporations are currently using or considering the system to help control sediment production.

The expected reductions in road surface sediment vary depending on site conditions such as precipitation, composition of the road surface, traffic levels, and other factors. However, the underlying principles responsible for the reduced sediment—shallower ruts and less concentrated flow—are expected to produce similar results in other locations. An effort is currently underway by the Forest Service Intermountain Research Station and the San Dimas Technology and Development Center to develop guidelines for quantifying the expected reductions in road surface sediment in various situations across the country.

[For additional information, contact Paul Greenfield, Program Leader—Roads, San Dimas Technology & Development Center, U.S. Forest Service, 444 East Bonita Avenue, San Dimas, CA 91773. Fax: (909) 599-2309.]

---

## Nutrient Studies Address Nitrate Removal from Groundwater

### *Groundwater Nitrate Removal in Riparian Buffer Zones*

by A.J. Gold and P. M. Groffman

Riparian zones have received considerable attention for their potential as a “second line of defense” in removing contaminants associated with upland activities in agricultural and rural watersheds. To evaluate the potential of riparian buffer zones to remove groundwater nitrate, and to identify the plant and microbial processes responsible for nitrate removal in riparian buffers, Gold and Groffman introduced solutions enriched with nitrate and a bromide tracer to groundwater through dosing wells in different soil types within a riparian forest in Rhode Island.

■ **Description.** Dosing wells were located at different groundwater depths in soils differing by drainage class (moderately well drained; somewhat poorly drained; and poorly drained). Each doser was surrounded by a nest of downgradient monitoring wells. Investigators quantified groundwater nitrate removal by coupling observations on the changes in the nitrate-tracer ratio with hydrologic factors at each dosing site.

Decreases in the concentration of the tracer were attributed to mixing, dispersion, and diffusion—assuming that these physical processes acted to reduce nitrate concentrations by the same amount. Decreases in nitrate concentrations in excess of the tracer were attributed to biological processes and collectively termed “removal.” Detailed measurements of plant root and microbial biomass and activity were made in close coordination with the groundwater studies to determine what processes contributed to observed nitrate attenuation.

■ **Results.** Gold and Groffman observed significant spatial and temporal variation in the site’s physical and chemical parameters and in nitrate removal rates over a distance of 60 feet between the driest and wettest locations within the riparian zone. Groundwater in the drier locations was strongly aerobic and well below the biologically active A and B soil horizons. In contrast, the groundwater in the wettest location was generally within the upper 20 inches of the soil surface and had low dissolved oxygen levels.

High groundwater nitrate removal rates were observed in the hydric location where soil is saturated for long periods of time and is anaerobic. Mean nitrate removal rates in poorly drained shallow groundwater were 70 percent higher than in the shallow groundwater of drier locations.

The spatial variation in nitrate removal rates suggests that using riparian zones dominated by upland or transitional soils to prevent nitrate movement from agricultural areas into streams may be less effective than using sites dominated by wetter, hydric soils. The scale of the spatial variation presents challenges for widespread adoption of soil drainage classes into practical management guidelines for riparian forests.

The study site, as is typical of many riparian areas in southern New England, had very finely divided soil drainage classes (separated by approximately 30 feet) with distinct nitrate removal capacities. However, the resolution of standard soil maps and groundwater maps often used in geographic information systems developed for land management is too coarse to incorporate

the observed differences. It may be necessary to develop high resolution, large-scale soil and groundwater maps to optimize the use of riparian areas for nitrate removal in agricultural watersheds.

Temporal patterns of nitrate removal in this study were complex. Removal rates did not increase significantly from March into June despite a groundwater temperature increase of more than 15 degrees Fahrenheit. But removal rates in November were more than double those in June, even though groundwater temperatures were lower in November. The fact that the highest removal rates were observed in the dormant season suggests that immobilization and denitrification processes, rather than plants, were responsible for much of the observed groundwater nitrate removal.

Laboratory microcosm studies confirmed that denitrification was the major microbial process involved in the removal of nitrate in the groundwater of the riparian zone. Carbon availability was found to control denitrification. Qualitative measurements within the saturated zone of the riparian soils suggests that the hydric soils have a greater incidence of high-carbon media than the drier locations.

[Pages 63-66 in Clean Water — Clean Environment — 21st Century, Team Agriculture Working to Protect Water Resources. Volume 2, Nutrients. Proceedings of a conference sponsored by the USDA's Working Group on Water Quality. Coordinated and published by the American Society of Agricultural Engineers, St. Joseph, MN. For further information on the poster, contact Professor A.J. Gold or P.M. Groffman at the University of Rhode Island, 336 Woodward Hall, Kingston, RI 02881. Phone: (401) 792-2903; Fax: (401) 792-4561.]

### *Use of Vegetable Oil To Bioremediate High Nitrate Well Water*

by W.J. Hunter and R.F. Follett

In the United States, the maximum permissible level for nitrate in drinking water has been set at 10 parts per million (ppm), a limit that is sometimes exceeded in many parts of the country. However, innocuous vegetable oil may provide the basis for a simple and inexpensive method of nitrate removal.

A proposed in situ method would use the injection of vegetable oil around the base of a well to cleanse nitrate from permeating aquifer water. Oil embedded in the aquifer matrix adjacent to the well would form an organic filter through which the water would infiltrate as it entered the well. Nitrate in the water would be removed as microbial denitrifiers use the oil as a carbon source.

■ **Description.** To evaluate this method (which was proposed by Streile et al. in 1991), Hunter and Follett conducted batch experiments in anaerobic static bioreactors using sand as the solid support, dilute buffer solution as the aqueous phase, and soil extract as the source of denitrifiers. The major treatment variables included the type of substrate used, concentration of oil, and concentration of nitrate, while the major determinations were the rate of substrate disappearance, rate of nitrate loss, and rate of nitrite formation.

■ **Results.** Both corn and soybean oils are good carbon sources for denitrification. With both oils only a short period of time, 24 to 48 hours, was required for the denitrifying population to begin denitrification with vegetable oil as a sole carbon source. Denitrification proceeded over a wide range of oil concentrations. Oil in water mixtures from 0.8 to 12.5 percent have been tested and found to support denitrification. Moreover, the amount of oil did not influence the rate of denitrification; no toxic effects were observed with the highest levels of oil.

High levels of nitrate, up to 180 ppm did not inhibit the process. But at 1,000 ppm of nitrate nitrogen and above, there was no detectable reduction in the amount of nitrate after eight weeks of incubation. As long as oil was present in excess, all detectable nitrate was removed by the process. However, nitrites may accumulate when substrates are limiting. Accumulations were greater with corn and soybean oil than with glucose.

[Pages 79-82 in Clean Water — Clean Environment — 21st Century, Team Agriculture Working to Protect Water Resources. Volume 2, Nutrients. For further information on the poster, contact W.J. Hunter, Microbiologist, Soil-Plant Nutrient Research Unit, USDA-ARS, 1701 Center Avenue, Fort Collins, CO 80526. Phone: (970) 498-4208; Fax: (970) 482-2909.]

---

# **Notes on Environmental Education (and having fun at the same time)**

---

## *How Do We Develop Local Stewardship?*

The increasing emphasis on educating and engaging the public in watershed activities points to a growing recognition of grassroots support as a key factor in successful protection and restoration efforts. The capacity to change both our thinking and our behavior is an important factor in minimizing nonpoint source pollution. Because this kind of change starts at a local level, we asked local, state, and national educators and activists for their thoughts on how to develop local stewardship. Here is what they told us.

■ Environmental Consultant Abby Markowitz, former program manager for Maryland Save Our Streams (See *News-Notes* issue #37, July-August 1994), and member of the board of directors of the Maryland Volunteer Water Quality Monitoring Association:

We must develop and sustain an active and articulate citizen constituency for local waters so that environmental protection is among the criteria used to weigh decisions and influence actions. In other words, we must acquire and perpetuate an ethic of environmental stewardship.

Our success in developing a nation of environmental stewards is directly tied to our commitment to and proficiency in building and nurturing local community leadership. Stewardship, like many characteristics, exists on a continuum. A person's sense of stewardship and active participation may extend only as far as a neighborhood stream. Another may become a volunteer monitor in a larger area. Stewardship to yet another person may include organizing watershed residents to participate actively in land use policy decisions.

We need to expand our definition of education to provide opportunities for people to grow into stewardship. An environmental stewardship strategy should include opportunities for training in grassroots fundraising, public speaking, legislative literacy, the policymaking process, and coalition building as well as technical issues.

Equally important for agencies and organizations who want to foster stewardship and community leadership development is an understanding that stewardship breeds debate and involvement in decision making. Be prepared to share decision making. Ultimately, programs are strengthened through community leadership development, but the road may be rocky at times.

*[For more information, contact Abby Markowitz, Tetra Tech, 10045 Red Run Boulevard, Suite 110, Owings Mills, MD 21117. Phone: (410) 356-8993.]*

■ Karol Keppy, project manager of Know Your Watershed, a national initiative that provides assistance for organizing watershed management projects (see *News-Notes* #39, January-February 1995):

Local stewardship can't be "done" from the national level. However, the roles that national, regional, and state leaders play are extremely important in developing local stewardship.

A recent survey of local watershed partnerships shows the type of information most needed by local leaders. These groups are looking for information on innovative funding strategies, local outreach ideas, watershed health assessment, and best management practices.

From the national level, we can provide both information and tools to help citizens begin a local watershed partnership. For instance, Know Your Watershed works through a vast array of partners to transfer research and technology to those who need it. In addition, national partners provide "starter kits" and networking capabilities for coordinated assistance to local watershed partnerships. This network, now available on disk, will soon be accessible through the Internet.

We also use the Conservation Technology Information Center's national public-private partnership as model for state and local partnerships. These partnerships are based on trust and communication between all the partners, but the commitment of one party can initiate the process.

[For more information, contact Karol Keppy, Know Your Watershed, Conservation Technology Information Center, 1220 Potter Dr., Room 170, West Lafayette, IN 47906. Phone: (317) 494-9555.]

- Elaine Andrews, developer of the 4-H program "Give Water a Hand" (see *News-Notes* #40, March-April 1995), and the "Educating Young People about Water" educational guides:

Our youth and their families make decisions every day that affect our water quality or quantity. To improve water stewardship, educators need to expand high quality water education opportunities to all of these decision makers.

The ultimate goal of any water education program is to help people develop the knowledge and conviction necessary to voluntarily choose behaviors that maintain or improve water quality in their communities. Leaders need to base their educational programming on community issues and involve natural resource managers to help focus attention on needed action.

At the heart of successful stewardship programs are education components that help develop a personal motivation and a knowledge base necessary for effective action.

Equally important are opportunities to apply newly acquired knowledge and skills. It also helps to provide opportunities for fun and recreation linked to the resource or to stewardship activities.

[For more information, contact Elaine Andrews, Cooperative Extension, University of Wisconsin, Environmental Resources Center, Agriculture Hall, Room 216, 1450 Linden Drive, Madison, WI 53706-1562. Fax: (608) 262-2031.]

---

## Touch-Screen Technology Enlivens Environmental Ed

Thousands of visitors to the Discovery Center and Aquarium in Pierre, South Dakota, have seen the future of the state's forests, driven a space-ship across South Dakota's varied landscapes, solved a murder mystery, or single-handedly restored an ailing ecosystem. "Forest and Water Adventures," a state-of-the-art, interactive, touch-screen exhibit uses these exciting scenarios to teach fourth through sixth grade audiences (and their adult chaperons) about South Dakota's forest and water resources.

The brainchild of Roy Richardson of the South Dakota NPS Pollution Information and Education Program, the kiosks were developed with the assistance of South Dakota's Departments of Environment and Natural Resources, U.S. EPA, and the state Division of Forestry. The South Dakota Tree Farm Committee, Society of American Foresters, Keep South Dakota Green, and other agencies and nonprofit organizations also contributed to the kiosks.

A portable version of the exhibit is now available for display at meetings, trade shows, fairs, visitor centers, and other indoor events. Five different games entertain and teach:

- In "Forest and Water Resources," the players travel in a space ship. Approaching planet Earth, the ship zeros in on South Dakota, pausing at different sites to explore the forest and water resources.
- In "Wendy's World," the player moves Wendy Water through a watershed with the twin goals of making money and protecting Wendy's health. Players decide which Best Management Practices are good for logging, farming, and ranching, and which are best in an urban area. The stakes are heightened by the fact that the heroine, Wendy, falls ill if the player makes the wrong choices.
- In the "Forest Time Machine," players manage a forest for timber, deer, or water resources over a 120-year time span. Before the game concludes, they see the end results of their decisions.
- Wendy Water appears again in "Wendy's Mystery." Here players must help her find the killer of Larry Lake. The cause of death and guilty parties change each time the game is played.



- "Focus On Forests" begins with the destruction of all forests in the United States. Players locate seedlings to restore each forest type and plant them in the proper locations to reforest the country.

Rod Frederick, of EPA's Nonpoint Source Control Branch, played a round of "Wendy's World." "It's a fun tool," he said. "It teaches young people and adults how to select basic controls for nonpoint sources of pollution."

[For more information, contact the Nonpoint Source Information and Education Program at the South Dakota Department of Agriculture. Phone: (605) 773-5276.]

---

## The Greening of the Schoolyards

Across Maryland, empty expanses of lawn in schoolyards are giving way to more interesting vistas: wildflower meadows, bluebird trails, and wetlands teeming with iridescent dragonflies.

In summer 1994, the U.S. Fish and Wildlife Service (FWS) surveyed Maryland schoolyards looking for opportunities to enhance wildlife habitat. Across the state, they found approximately 5,912 acres of turfgrass that were suitable for conversion. Challenging students to convert these areas to better wildlife habitat has several benefits. Each project becomes an opportunity for students to apply newly learned skills and to model land stewardship for the community. And each restored area becomes a community resource — a natural area for educational use and exploration, a more aesthetic school landscape, a vegetative buffer for nearby streams, and an increased wildlife habitat.

### *Hands-on Learning Effective and Fun*

Thanks to a \$6,000 grant and the assistance of the U.S. Fish and Wildlife Service and the Chesapeake Bay Trust, students at Seven Oaks Elementary School in Perry Hall created their very own demonstration wetland. They put the finishing touches on their creation on Earth Day 1995, by planting hundreds of wetland plants. The project also got assistance from the Baltimore County Forest Conservancy District Board, Baltimore County Public Schools, and the Department of Environmental Protection and Resource Management.

National Civilian Community Corps volunteers helped students research native wetland plants and select a variety of shrubs, herbaceous plants, and colorful wildflowers. Already the wetlands are attracting a variety of wildlife; students have observed toads, frogs, salamanders, song and shore birds, and dragonflies.

"Seven Oaks students are literally taking habitat restoration into their own hands," said Karen Schafer, principal of the elementary school. "The teachers deserve much of the credit for the success of this project. They have been able to meet educational goals while involving the students in all stages of the project from planning and planting to monitoring. This type of hands-on learning is not only very effective, it's fun!"

The FWS and the Trust have also been working with the Maryland Department of Natural Resources, Environmental Concern, Inc., and the state Department of Education to involve students and teachers in other Maryland counties in planning and developing habitats on school properties. Projects range from creating wetlands and wildlife corridors to reforestation and planting wildflower meadows, no-mow streamside buffers, and butterfly gardens.

[For more information, contact Rich Mason, U.S. Fish and Wildlife Service, Chesapeake Bay Field Office, 177 Admiral Cochrane Drive, Annapolis, MD. Phone: (410) 573-4584.]

---

## Georgia Adopt-A-Stream Goes Hi-Tech

Following the advice of the age-old adage "two heads are better than one," Georgia Adopt-A-Stream is conducting teleconferences to connect stream monitors at hundreds of educational sites across the state.

The teleconferences are made possible by compressed audiovideo technology transmitted over telephone lines connected to Georgia Statewide Academic and Medical (GSAMS) Distance Learning Network sites. Sponsored by Georgia Adopt-A-Stream, the teleconferences will help spread the popular Adopt-A-Stream program to community groups who might find it difficult to travel to a workshop. Georgia Adopt-A-Stream is an umbrella organization that combines

community group efforts, training, and technical expertise to improve water quality in the state (see *News-Notes* #40 March / April 1995).

Facilitating two-way communication between as many as four sites at a time, the teleconferences allow Georgia Adopt-A-Stream water monitors to interact with their colleagues across the state. The link gives volunteers the opportunity to exchange valuable information about their progress, the quality of their streams, the pollution issues they face, and their solutions to these problems. Such communication unites volunteers in a widespread, grassroots effort to address stream quality, while offering education and technical training for addressing pollution issues.

Georgia Adopt-A-Stream has already conducted two teleconferences connecting Georgia stream monitors in the summer and fall of 1995. Two more are planned for winter and spring 1996.

[For Adopt-A-Stream information, contact Laurie Hawks, Georgia Adopt-A-Stream, Environmental Protection Division, 7 Martin Luther King Dr. SW, Suite 643, Atlanta, Georgia 30334. Phone: (404) 656-4988. For GSAMS information, contact Shannon Reeves, GA Statewide Academic and Medical System, University of Georgia, GA Center for Continuing Education, Suite 298, Athens, GA 30602-3600. Phone: (706) 542-7757.]

---

## NPS Electronic Bulletin Board News

---

This portion of *News-Notes* is prepared for the benefit of *News-Notes* readers who are regular users of U.S. EPA's *NPS BBS*.

**Nonpoint Source Electronic Bulletin Board System.** EPA's *NPS BBS*, through the user's personal computer, provides timely, relevant NPS information; a nationwide forum for open discussion; and the ability to exchange computer text and program files. Specific Issue Groups (SIGs or minibulletin boards) are dedicated to specific topics. Currently, there are seven SIGs on the *NPS BBS*: Watershed Restoration, Agriculture, TMDLs, Waterbody System Support, NPS Research, Volunteer Monitoring, and Coastal NPS Control. All articles from all issues of *News-Notes* are stored on the *NPS BBS* and may be retrieved on your personal computer. A searchable *News-Notes* database helps you find the information you need.

To access the *NPS BBS*, you will need a PC or terminal, telecommunications software (such as Crosstalk or ProComm), a modem (1200, 2400, or 9600, or 14,400 baud), and a phone line. The *NPS BBS* phone number is (301) 589-0205. Parameters are N-8-1.

The *NPS BBS* may also be accessed from the Internet by typing TELNET FEDWORLD.GOV. Once on FedWorld, turn ANSI graphics off and go through the Gateway to NPS-BBS, or command D 79.

---

## NPS Information Exchange Moves to the 'Net

The NPS Information Exchange is going global. After nearly 5 years online, the modem-based water information bulletin board is phasing over to the Internet. Spurred by advancing technology and EPA budget cuts, the move follows several years of researching user needs for an economical, accessible system integrated with EPA's other water information systems.

The transition from BBS to Internet will be completed by January 1, 1996. The NPS BBS will remain fully functional until then, but the NPS Information Exchange on the Internet will be expanding to fill its new, larger niche. Several key features will carry over from the original NPS BBS, but its new configuration will make use of file servers, list servers, gophers, and the World Wide Web. For example, many publications are readable online, most are available for file transfer, and some are "hot linked" to related information.

In addition to new routes to familiar functions, the Web site's full-color graphics will provide fresh possibilities for finding and viewing information. Geographical information, for example, might be viewed in map or GIS format, and users may point or click to reveal data about specific locations.

While much of the Information Exchange is "under construction," the last several issues of *News-Notes* and a number of other documents are now on the Web site, or "page." The address is <http://www.epa.gov/OWOW/NPS/npsie.html>

NPSINFO, the Information Exchange's e-mail discussion group, opened in September. All you need to access NPSINFO is an e-mail account. To subscribe to NPSINFO, send a message to "listserver@unixmail.rtpnc.epa.gov" and include in the body of the message

subscribe NPSINFO yourfirstname yourlastname.

After you subscribe, you will receive a welcome message explaining the discussion list and its help features. To post to the list, send messages to

npsinfo@unixmail.rtpnc.epa.gov

Yes, the NPS Information Exchange is cutting loose its modem to float free on the 'Net. It will, however, continue to be a forum for communicating about technical, educational, and policy issues related to nonpoint source pollution. Stay tuned!

---

## Reviews and Announcements

---

### *A Citizen's Guide to Riparian Area Management*

With over 400 miles of streams draining into 170 lakes and rivers, it comes as no surprise that residents of the 480 square miles of Lake County, Illinois, are concerned about eroding streambanks and shorelines. To help residents control erosion and protect riparian areas, the Lake County Stormwater Management Commission used a 319 grant to develop a citizen's guide for riparian area management.

The citizen's guide covers water quality, riparian habitat, flooding, property value, and safety issues. It educates riparian homeowners on the causes and impacts of soil erosion, water quality degradation, and the importance of using BMPs for watershed management. In six sections it identifies the principles of riparian management:

- *More is not better* addresses nutrient impacts from the misapplication of lawn fertilizer and provides proper application methods.
- *No dumping allowed* details nutrient impacts of yard waste and supports composting.
- *Excess debris spells disaster* discusses the environmental and safety implications of "urban artifacts," such as the tires and natural debris that travel in stream channels.
- *Plant yourself some roots* focuses on the benefits of establishing rooted streambank cover to prevent erosion; buffer strips to filter pollutants, and tiles, storm sewer outlets, and other concentrated flow outlets to manage runoff.
- *Short grass doesn't cut it* explains the negative impact of short grass on pollutant filtering ability, wildlife habitat, and weed and drought resistance.
- *Tune into your channels* highlights the benefits of natural, meandering channels in comparison to straightened channels and advocates vegetative structures to stabilize streambanks and shorelines.

Other sections discuss how to properly install bank stabilization measures and the advantages of native plants. While the six principles are applicable across much of the United States, Lake County residents will also find the inclusion of local resource agency contacts especially useful.

To date, the Commission has distributed nearly 5,000 copies of the citizen's guide.

[For a free copy of *Riparian Area Management: A Citizen's Guide*, contact the Lake County Stormwater Management Commission, 333-B Peterson Road, Libertyville, IL 60048. Phone: (708) 918-5260.]

---

## National Resources Inventory Report Offers "Snapshot" of Nation's Natural Resources

Soil erosion declined from 4.1 tons per acre on 421 million acres in 1982 to 3.1 tons per acre on 382 million acres in 1992, according to the 1992 National Resources Inventory (NRI) Summary Report recently released by the Natural Resources Conservation Service (NRCS). Compiled every five years, the NRI provides soil, water, and resource data on the nation's farms, nonfederal forests, and grazing lands collected from over 800,000 sample sites across the nation. The inventory also reveals that

- the total acreage of irrigated land remained stable from 1982-1992;
- roughly 4,000,000 acres of prime farmland were converted by development from 1982 to 1992;
- nearly 40 percent of all cropland erosion (wind and water) occurred in five states: Texas, Minnesota, Iowa, Montana, and Kansas; and
- 67 percent of cropland soil savings from 1982-1992 resulted from reductions in erosion on highly erodible land.

A four-page summary with resource data, graphic illustrations, and fact sheets about the 1992 National Resources Inventory is currently available from the NRCS.

[For a copy of the summary or information on how to obtain the database, contact Ted Kupelian, Natural Resources Conservation Service, P.O. Box 2890, Washington, DC 20013-2890. Phone: (202) 720-3210; Fax: (202) 690-1221.]

---

## USDA Video Presents Facts on Cryptosporidium

Responding to an emerging issue involving pathogens in water, the USDA has developed a 22-minute videotape, "Cryptosporidium and Cryptosporidiosis: The Parasite and the Disease."

The video covers the parasite's life cycle, geographic distribution, groups at risk, and clinical signs of the disease. Featuring Ron Fayer, a USDA Agricultural Research Service specialist in animal diseases that affect humans, the video also presents current methods of detection, recent surveys of farm animals, raw water surveys, and modern-day outbreaks of cryptosporidiosis in humans.

The video is available from state offices of the Cooperative Extension and most major water companies or utilities.

---

## Nonprofit Council Supports Habitat Enhancement on Nonpublic Lands

The Wildlife Habitat Council (WHC), a nonprofit, nonlobbying organization dedicated to the enhancement and preservation of wildlife habitat on corporate lands, held its seventh annual symposium and banquet, November 6 - 7, 1995, at the Washington Marriott Hotel in Washington, D.C.

Founded to protect and enhance wildlife habitat and foster environmental values in the corporate culture, WHC helps companies manage their undeveloped corporate lands and encourages them to open these lands to the public. WHC activities foster teamwork. Through its efforts, employees, conservation organizations, government agencies, and communities learn how to accommodate wildlife on corporate lands, in industrial areas, right of ways, mining properties, and along buffer zones. The teams plant trees, build nesting boxes, construct nature walks, provide raptor perches, and (in South Carolina's long-leaf pine forests) practice prescribed burning.

Habitat enhancement is especially important, say WHC representatives, because ecosystem or watershed-based approaches must be aware of how habitat affects water quality and biotic integrity. Special awards are given for "Rookie of the Year," and "Corporate Habitat of the Year," and any companies that make a documented commitment to wildlife enhancement or environmental education are eligible for certification.

[For more information on WHC, contact Cynthia Gaver, Wildlife Habitat Council, 1010 Wayne Avenue, Suite 920, Silver Spring, MD 20910. Phone: (301) 588-8994; fax: (301) 588-4629.]

# Datebook

DATEBOOK is put together with the cooperation of our readers. If you would like a meeting or event placed in the DATEBOOK, contact the *NPS NEWS-NOTES* editors. Due to an irregular printing schedule, notices should be in our hands at least two months in advance to ensure timely publication. A more complete listing can be found on the *NPS BBS*.

## Meetings and Events

1995

### November

- 14-16 *Upper Columbia Basin Water Resources Workshop*, Coeur D'Alene, ID. This workshop brings together resource user groups of the Upper Columbia Watershed to build a coalition necessary to protect water quality, while considering the interests of cities, industries, agriculture, and hydropower. Contact Chuck Scheerschmidt, Upper Columbia Resource Conservation and Development Council, 1101 N. Argonne, Suite 215, Spokane, WA 99212. (509) 353-2187. Fax: (509) 353-2311.
- 14-16 *California's Riparian-River Ecosystems Conference IV*, Sacramento, CA. Addresses current land use and resource conflicts. Sponsored by UC Davis University Extension, Davis, CA. Contact University Extension, University of California, Davis, CA 95616-8727, 4W44. (800) 752-0881. From Davis, Dixon, or Woodland, CA, call 757-8777. Fax: (916) 757-8558.
- 15-17 *Environmental Enhancement Through Agriculture*, Boston, MA. Contact Tufts University, Food and Environment, (617) 556-3000 or (617) 636-5000. Sponsored by Tufts University, Center for Agriculture, Food and Environment; American Farmland Trust; and Henry A. Wallace Institute for Alternative Agriculture. This conference will examine how agriculture can contribute positively to the environment while remaining productive and profitable.
- 28-30 *International Erosion Control Association (IECA) Industry Training Courses*, Houston, TX. Contact IECA, P.O. Box 774904, Steamboat Springs, CO 80477-4904. (800) 455-4322. Fax: (970) 879-8563. Courses cover practical approaches for effective erosion and sediment control, bioengineering techniques for streambank and lakeshore erosion control, and design methods for channel protection and streambank stabilization.
- 30-12/1 *A Quality Landscape: Economic Vitality and Environmental Stewardship in the Chesapeake Bay Watershed*, Sheraton Reston Hotel, Reston, VA. Contact James Noonan, Maryland Office of Planning. (410) 225-4562.

### December

- 2 *Sustainable Development Conference*, Dallas Marriott Quorum, Dallas, TX. Sponsored by the Council on Information on Sustainable Development. Contact Dr. Seyoum Zegiorgis, 3617 Yosemite Drive, Plano, TX 75023. (214) 613-7591 or (214) 422-9797. Fax: (214) 686-4175. E-mail: seyoum-zeg@etsu.edu
- 4-6 *Mine Drainage Workshop*, Cincinnati OH. Topics: historical perspective, partnering for success, and accountability reports, the 1995 Statement of Mutual Intent and other partnerships. Contact: Terrene Institute, 1717 K Street NW, Suite 801, Washington, DC 20006. (202) 833-8317. Fax: (202) 296-4071.
- 7 *10th Annual Grazing Lands Forum*, Washington, DC. Contact: George Ramey, BLM (WO-330), 1849 C Street N.W., Washington, DC. (703) 313-9579 or (202) 452-7747. Sponsored by the National Capitol Section of the Society for Range Management.
- 7 *California Department of Food and Agriculture, Fertilizer Research and Education Program Conference*, University of California, Kearney Agricultural Center, Parlier, CA. Co-sponsored by CDFA, the California Fertilizer Association, and the University of California. Nitrate contamination of groundwater from agricultural sources is the focus of this conference. Contact Debbie Scott or Casey Walsh-Cady, CDFA Fertilizer Research and Education Program, 1220 N Street, Sacramento, CA 94271-0001. (916) 653-5340.
- 12-15 *National Agricultural Ecosystem Management Conference*, New Orleans, LA. Contact Lyn Kirschner. (317) 494-9555.

1996

### February

- 26-27 *Urban Conservation 2000: A Virtual Reality*, Seattle, WA. Sponsored by the Soil and Water Conservation Society, Contact Nancy Herselius, ext. 18, or Timothy Kautza, ext. 12. 1-800-THE-SOIL. Or see the World Wide Web home page at <http://www.netins.net/showcase/swcs/>

**1995**

**February**

- 27-29 *11th Thematic Conference on Geologic Remote Sensing*, Las Vegas, NV. Contact: ERIM, P.O. Box 134001, Ann Arbor, MI 48113-4001. (313) 994-1200. Fax: (313) 994-5123. Will focus on geologic remote sensing technologies and GIS, with special emphasis on solving real-world problems related to mineral and hydrocarbon exploration.
- 27-3/1 *27th Annual International Erosion Control Association (IECA) Conference and Trade Exposition*, Seattle, WA. Contact: Tracy Zuschlag, IECA Program Administrator, P.O. Box 4904, Steamboat Springs, CO 80477-4904. (800) 455-IECA. Fax: (970) 879-8563. This conference will provide information on water and air quality issues, soil conservation, and many other problems related to erosion and sediment control in the urban, metropolitan, industrial, and construction sectors.

**March**

- 11-15 *Hec-1: Flood Plain Hydrology*, New Brunswick, NJ. Contact Suzanne Soules, Cook College Office of Continuing Professional Education, P.O. Box 231, New Brunswick, NJ 08903-0231. (908) 932-9271.
- 20-21 *GEMI '96: Agenda for a Changing Environment*, Arlington, VA. Sponsored by the Global Environmental Management Initiative. Topics include the regulatory framework, environmental health and safety management practices, and the emerging global marketplace. Contact: GEMI '96 c/o JT&A, inc., 1000 Connecticut Avenue NW, Suite 802, Washington, DC. (202) 833-3380. Fax: (202) 466-8554.
- 20-23 *NALMS' Fifth Annual Southeastern Lakes Management Conference*, Huntsville, AL. Contact Gary Springston, Tennessee Valley Authority. (423) 751-7336.

**April**

- 21-26 *Hydrology and Hydrogeology of Urban and Urbanizing Areas*, Boston, MA. Contact: Helen Klose, American Inst. of Hydrology, 3416 University Ave. SE, Minneapolis, MN 55414. (612) 379-1030. Fax: (612) 379-0169. E-Mail: AIHydro@aol.com

**Calls for Papers—Deadlines**

**1995**

**December**

- 1 *American Water Resources Association's 32nd Annual Conference and Symposium, GIS and Water Resources*, Ft. Lauderdale, FL, September 22-26, 1996. Paper and poster abstracts are sought for GIS-related topics. Contact Cheryl A. Hallam, USGS, National Center, MS 521, Reston, VA 22092. (703) 648-4525. Fax: (703) 648-5755. E-mail: challam@usgs.gov.
- 31 *Seventh Annual Florida Lake Management Society Conference*, May 22-24, 1996, Ocala, FL. Contact: The Florida Lake Management Society, c/o Mark Hoyer, U.F. Department of Fisheries, 7922 N.W. 71 Street, Gainesville, FL 32653. (904) 392-9617, ext. 227.

**Correction and Update**

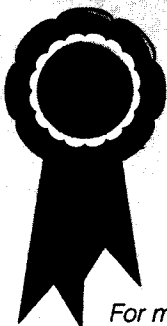
In the last issue, we incorrectly identified NACD as sponsor of Envirothon, a national environmental competition for high school teams (see "Getting Down and Dirty — Envirothon Teams Win on Soils Knowledge," *News-Notes* #42, pages 20-21).

This year's contest took place July 31 to August 4, 1995, at Ricks College in Rexburg, Idaho. The Idaho Association of Soil Conservation Districts, the Idaho Soil Conservation Commission and the USDA Natural Resources Conservation Service hosted the meeting, which was sponsored by the Monsanto Fund. The training and testing station sponsors included Utah Power and the Union Pacific Foundation.

Teams from 28 states and two Canadian provinces competed in the event, the first-ever national envirothon to be held west of the Mississippi. The top five teams at the 1995 competition were

- |              |  |
|--------------|--|
| First Place  | Coventry High School, Haddam, CT               |
| Second Place | Keene High School, Keene, NH                   |
| Third Place  | Greece Athena High School, Rochester, NY       |
| Fourth Place | Kittatinny Regional High School, Newton, NJ    |
| Fifth Place  | Franklin Regional High School, Murrysville, PA |

For more information, contact Bill Kahler, Chairperson, The National Envirothon Committee at (717) 327-3571.





*Nonpoint Source NEWS-NOTES* is an occasional bulletin dealing with the condition of the water-related environment, the control of nonpoint sources of water pollution, and the ecosystem-driven management and restoration of watersheds. NPS pollution comes from many sources and is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural pollutants and pollutants resulting from human activity, finally depositing them into lakes, rivers, wetlands, coastal waters, and groundwater. NPS pollution is associated with land management practices involving agriculture, silviculture, mining, and urban runoff. Hydrologic modification is a form of NPS pollution that often adversely affects the biological integrity of surface waters.

Editorial contributions from our readers sharing knowledge, experiences, and/or opinions are invited and welcomed. (Use the COUPON on page 31.) However, *NEWS-NOTES* cannot assume any responsibility for publication or nonpublication of unsolicited material or for statements and opinions expressed by contributors. All material in *NEWS-NOTES* has been prepared by the staff unless otherwise attributed. For inquiries on editorial matters, call (202) 260-3665 or FAX (202) 260-1517.

For additions or changes to the mailing list, please use the COUPON on page 31 and mail or fax it in. We are not equipped to accept mailing list additions or changes over the telephone.

*Nonpoint Source NEWS-NOTES* is produced by the Terrene Institute under an EPA Cooperative Agreement (# 820957-01) from the Assessment and Watershed Protection Division, Office of Wetlands, Oceans and Water, U.S. Environmental Protection Agency. It is distributed free of cost. Views expressed do not necessarily reflect those of EPA or the Terrene Institute. Mention of commercial products or publications does not constitute endorsement or recommendation for use by EPA or the Terrene Institute.

NONPOINT SOURCE

## *News-Notes*

c/o Terrene Institute  
1717 K Street, NW  
Suite 801  
Washington, DC 20006

NONPROFIT ORG.  
U.S. POSTAGE  
**PAID**  
Merrifield, VA  
Permit No. 1308