

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

Nutrient Criteria on the Horizon

EPA has formed a national team of specialists that is leading an effort to develop measures of nutrient over-enrichment of surface waters. Nutrient loading is one of the top causes of degradation in lakes, rivers, and estuaries, according to the 305(b) Reports to Congress over the last two decades. During the next two years, the group will develop technical guidance for four sets of nutrient criteria: lakes and reservoirs, rivers and streams, coastal marine waters and estuaries, and wetlands. States and tribes can use the guidance in setting nutrient criteria, which are numbers that represent the amount of specific nutrients that can exist in a waterbody and still allow it to support its designated use.



The CWAP logo seen throughout this issue denotes articles related to action items called for in the President's Clean Water Action Plan. See News-Notes #51 and #52 for more information on the plan.

At the regional level, 10 technical assistance groups are forming, led by a nutrient coordinator from each of EPA's 10 regions and made up of experts and scientists. Key members are being drawn from federal and state government agencies and educational and research institutions. These technical advisory groups will provide technical and financial help to states and tribes in setting nutrient criteria that can be used to identify problems; prioritize restoration efforts; plan management projects; set permit limits and refine TMDLs; evaluate the success of management activities; and help communicate the status of water resources.

One of the first tasks of the technical advisory groups is to evaluate a draft nutrient ecoregion map and select reference conditions for each type of waterbody in each nutrient ecoregion. The reference conditions serve as starting points for developing the nutrient criteria that can be used to evaluate actual conditions in the waterbodies being assessed.

EPA has taken an important step toward the development of both reference conditions and the eventual setting of nutrient criteria by screening the STORET database for data on total nitrogen, total phosphorus, chlorophyll a, and Secchi depth in each of the four waterbody types. However,

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EPA will encourage states and tribes setting criteria to go beyond these parameters to include biological data and any other variables that are appropriate, emphasizing inclusion of both causal indicators (e.g., nutrients) and response indicators (e.g., chlorophyll *a* and dissolved oxygen).

EPA encourages states to base their own criteria on the following five elements: historical records, reference conditions, modeled projections, the technical advisory groups' evaluation of data, and attention to downstream impacts.

A draft technical guidance manual for setting nutrient criteria for lakes is expected by the end of 1999. Guidance documents on streams and rivers, and coastal waters and estuaries will soon follow.

[For more information, contact George Gibson, U.S. EPA Laboratory, 839 Bestgate Rd., Annapolis, MD 21401. Fax: (410) 573-2698; email: gibson.george@epa.gov.]

Currently lending their expertise to the effort are professionals from the USDA, U.S. Geological Survey, and National Oceanic and Atmospheric Administration.

Expertise and input are also being sought from universities and state and tribal departments of natural resources, water resources, environmental management, fisheries and wildlife, agriculture and forestry, and from other land-use management agencies.

Achievements and Changes for the Coastal Nonpoint Program

It took longer than expected, but as of June 30, 1998, 29 coastal states and territories have conditionally approved coastal nonpoint pollution control programs. They also have new federal guidance that provides more realistic implementation schedules and more flexibility to decide when and where to direct their energies.

The law that started it all, the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA), mandated that states and territories with approved coastal zone management programs develop and implement coastal nonpoint programs.

CZARA employed an innovative approach. First, two federal agencies, NOAA and EPA, shared responsibility for developing the framework for the program. Then, states for the first time brought together the land-use management expertise of their coastal zone agencies and the water quality expertise of the their 319 agencies.

In 1993, EPA and NOAA published technical and programmatic guidance to help the states develop their programs. The programmatic guidance, in particular, stimulated additional discussion between the federal and state agencies that has now led to a final set of flexible guidelines to assist states in achieving full approval and moving ahead in implementing programs that will control polluted runoff.

After providing a 60-day comment period and drafting responses to comments, EPA and NOAA issued final administrative changes to the program guidance on October 21, 1998—changes that grant states an extended timeframe (15 years) to achieve full implementation of their management measures and allow them to focus priority activities on specific water quality problems and watersheds. Completing the conditional approval process and issuing the final guidance support a “key action” called for in the President’s Clean Water Action Plan issued on February 19, 1998:

NOAA and EPA will work with coastal states and territories to ensure that they have developed programs to reduce polluted runoff in coastal areas and that these programs are at least conditionally approved by June 1998 and that all programs are fully approved by December 1999, with appropriate state-enforceable policies and mechanisms.

Targeting

Under the final guidance, states can choose when and where to focus their resources for preventing and controlling significant impacts of coastal nonpoint source pollution, allowing coordination and integration with other programs like state 319 nonpoint source and TMDL programs, the 1996 Farm Bill’s Environmental Quality Incentives Program, National Estuary Programs, and state



watershed planning. According to the revised guidance, "targeting program implementation will involve a balance between the need to implement nonpoint source controls broadly and the need to address specific water quality problems for particular watersheds." States can also exclude geographic areas or sources of nonpoint pollution that do not contribute significantly to coastal water quality problems. States must identify their program priorities in a 15-year program strategy approved by NOAA and EPA.

Enforceable Mechanisms and Policies

The recent changes to the guidance provide new routes for approval of the authorities the states use to ensure implementation. When states propose to use voluntary or incentive-based programs backed by existing state enforcement authorities, they can provide EPA and NOAA with a legal opinion from the state attorney general affirming that existing state authorities can be used to prevent nonpoint pollution and require management measures. Such an opinion, supported by a description of the voluntary programs and the mechanism that links the implementing agency with the enforcement agency and a commitment to use the existing enforcement authorities where necessary, will allow states to remove conditions on their programs associated with enforceable policies and mechanisms.

NOAA and EPA will also approve program elements for which states have proposed the use of section 401 Clean Water Act certifications and Coastal Zone Management Act consistency certifications in cases where states can meet certain conditions.

Timeframes

States will still have up to five years after conditional approval to meet conditions, with an evaluation of progress after three years, but the changes grant some leeway in schedules for implementation of the entire program. Rather than rigid schedules for implementing management measures, monitoring, and additional management measures, states can now iteratively implement management measures, assess effectiveness in achieving water quality goals, and determine the need for additional management measures on a continuous basis.

And while in some cases positive impacts on water quality may not be seen for many years, EPA and NOAA expect that management measures will be implemented to address all types of nonpoint source pollution in coastal watersheds within 15 years.

Evaluation

Nested within each state's 15-year program strategy is to be a series of 5-year implementation plans with benchmarks against which EPA and NOAA will measure progress. States must update the plans at least every five years. EPA and NOAA have promised to work with the states to develop an efficient and effective evaluation process.

Resources

In developing the newest administrative changes, NOAA and EPA committed to working with states, the environmental community, affected interests, and others to find sources of funding for continued development and implementation of the Coastal Nonpoint Program. The combined efforts have been successful in securing significant new resources through the Clean Water Action Plan. Based on final appropriations in the FY99 budget, NOAA has received a total of \$8 million for distribution to the states, which may use the funds to meet conditions and implement their coastal nonpoint programs. EPA has secured an additional \$100 million to support state nonpoint source programs under 319 grants—new resources that can be used to support state coastal nonpoint program implementation.

[For more information, contact Peyton Robertson, National Oceanic and Atmospheric Administration, 1305 East West Hwy., Silver Spring, MD 20910-3281. Phone: (301) 713-3098 x137; fax: (301) 713-4367; email: peyton.robertson@noaa.gov. To download a copy of the "Final Administrative Changes to the Coastal Nonpoint Pollution Control Program," visit NOAA's web site at www.nos.noaa.gov/ocrm/czm/6217/admin_changes.html.]



Draft Policy on Watershed Management on Federal Lands Coming

Federal agencies anticipate a late winter or early spring release of a draft policy outlining a unified watershed-based approach to federal land and resource management. *News-Notes* readers are encouraged to comment on the draft policy when it is published in the *Federal Register*. The policy will fulfill one of the key action items included in Clean Water Action Plan. The draft policy, developed by DOI and

USDA, in consultation with other federal agencies, states, and tribes, will guide federal agencies in watershed management activities to reduce water pollution and ensure the health of aquatic ecosystems on federal lands. Check EPA's "What's New" web site: www.epa.gov/epahome/WhatsNew.html to find out when the policy is published in the *Federal Register*.

National Estuary Program Joins Forces With NEMO

Adapted from *Coastlines*, Fall 1998, Volume 8, Number 4

According to EPA, urban runoff is the number one source of pollution in U.S. coastal waters, and polluted runoff is a direct reflection of land use. That is why EPA's Coastal Management Branch has entered into a partnership with the University of Connecticut's Nonpoint Education for Municipal Officials (NEMO) project.

Land use in the United States is primarily decided at the county and municipal levels of government, often by volunteer elected and appointed commissioners with little or no training in natural resource management. This critical group of community leaders needs education, easily used tools, and truly accessible information to enable them to do a better job of protecting natural resources while planning and developing their communities. NEMO was created in 1991 to address these issues. NEMO, which is led by University of Connecticut Cooperative Extension and funded primarily by the USDA Water Quality Initiative, was developed as a "spin-off" application of the satellite-derived land-use/land-cover information for Connecticut that was created for the National Estuary Program's Long Island Sound study.

NEMO initiatives are not restricted to Connecticut. The project is currently working with multi-agency coalitions in over 15 states to adapt NEMO to particular areas and priority natural resource issues. Project staff members have conducted 20 out-of-state "scoping" workshops, assisting these coalitions to assess the issues, target audiences, opportunities, and barriers to creating their own tailored version of NEMO. The potential of this ad hoc national network of NEMO-inspired projects is such that in December 1997, representatives from four federal agencies (USDA, EPA, NASA, and NOAA) formed the National NEMO Network Interagency Work Group to explore mechanisms for collaborative support of the project and the network.

The National Estuary Program collaboration is the first project to come out of the Interagency Work Group discussions. The need for better land-use decisionmaking has not gone unnoticed by National Estuary Program Management Conferences; not surprisingly, nonpoint source pollution and watershed management are featured throughout the system's Comprehensive Conservation and Management Plans (CCMPs).

EPA's Coastal Management Branch is funding NEMO to provide assistance to the National Estuary Program in developing educational programs in support of these key CCMP components. NEMO will conduct on-site scoping workshops for several of the newer National Estuary Program Projects. NEMO staff will work closely with the staff/committee members of the selected National Estuary Programs to develop the workshops.

The project will assist National Estuary Program members to initiate educational programs in support of better local land-use planning. The NEMO project is not advocating NEMO clones, but tailored adaptations that meet the needs of a given area. The National Estuary Program structure, with its many committees representing a wide range of interests and organizations, is an ideal framework for generating discussion on these needs, and on educational approaches.

What is NEMO?

NEMO uses GIS and remote sensing technologies to communicate the complex relationships between land use and water quality, making the issues “come alive” for local land-use decisionmakers. The project’s recommendations are based on good natural resource planning as the first line of defense, followed by improved site design, and lastly, the use of BMPs. NEMO’s emphasis on planning as the most cost-effective method of water resource protection has been welcomed by the planning community, which has given the project national and state awards for its work.

In addition to the basic land-use/water quality presentation, NEMO conducts a number of educational programs for Connecticut municipalities on topics ranging from open space planning to impervious surface reduction, and is engaged in several watershed projects with a host of partners, including the Connecticut Department of Environmental Protection, U.S. EPA’s New England office, The Nature Conservancy, and the U.S. Fish and Wildlife Service. Although effecting change at the local level takes time, NEMO has found that effective, professional educational programs can catalyze changes to local land-use plans, programs, and policies.

One of the project’s major objectives is to enable local officials to visualize the future impacts of their current land-use policies and plans. For instance, NEMO makes use of a zoning-based “build-out” analysis, which contrasts current levels of impervious surface (known to be a reliable indicator of the potential for water quality degradation) with future levels estimated from zoning regulations. The project is currently developing much more sophisticated visualization techniques, including the use of three-dimensional GIS and the internet-accessible GIS information and maps.

Regulatory Needs

Although NEMO’s planning and design approaches are non-regulatory, there are regulatory implications looming on the horizon for many of the country’s communities. In the future, increasing numbers of communities will require strategies and assistance to meet the proposed Phase Two stormwater permits and increased use of Total Maximum Daily Loads (TMDLs).

[For more information, contact Chester Arnold, University of Connecticut Cooperative Extension System, 1066 Saybrook Road, Box 70, Haddam, CT 06438-0070. Phone: (860) 345-4511 or (757) 566-1367; e-mail: carnold@canr1.cag.uconn.edu; web site www.canr.uconn.edu/ces/nemo].

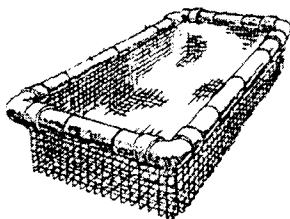
News from the States, Tribes, and Localities

Oyster Gardening Helps the Economy and the Environment

In Maryland and Virginia, bayside residents looking for a challenge can take up a new hobby and contribute to the Chesapeake Bay’s health at the same time. The Chesapeake Bay Foundation (CBF) is coordinating an effort to involve citizens, students, and organizations in restocking oyster reefs through backyard “oyster gardens.” The projects will help restore commercial oyster beds and filter pollutants from the Bay’s water. CBF hopes to increase the Bay’s oyster population tenfold by 2005.

Participants attend a workshop where they learn about oyster ecology and are trained in oyster aquaculture. Each builds a oyster float made of PVC pipe and receives 2,000 seed oysters. Placed in mesh bags in vinyl-coated wire cages strapped to the pipe, the oysters grow for two years until they are about two inches long. Owners can then harvest the oysters or collect them for replanting on a sanctuary reef in local waters where harvesting is prohibited. Nearly 400 oyster gardeners participate in CBF’s oyster gardening program in Maryland, and another 250 are involved in the Norfolk, Virginia area.

Oysters have great historical, economic, and ecological significance in the Chesapeake Bay. Oysters supported the most valuable fishery in the Bay for more than 100 years, and the large reefs they form provide habitat for a wide range of plants and animals. Perhaps even more important for the Bay ecosystem is the oyster’s legendary ability to filter water. One oyster can clean as much as 50 gallons of water a day, removing sediment, algae, and nutrients as it feeds.



Most oyster floats are made of PVC pipe and wire mesh. This type of float is called a Taylor float.

Oysters deposit pollutants in small fecal pellets that become part of the sediment and are not harmful to the aquatic ecosystem. Removal of suspended solids increases the water's transparency so aquatic vegetation can receive sunlight. Problems arise when nutrients and algae overwhelm the oyster population's filtering capacity. Large decomposing algae blooms become a source of carbon for the bacterial community, increasing benthic biological oxygen demand and leading to anoxic conditions.

According to commercial harvesting reports, the Bay's oyster population is declining. Decades of overharvesting, as well as disease and pollution, have taken their toll. Annual catches have declined from close to 50 million pounds in the 1920s to the current 3 to 5 million pounds, and the impact of this loss is felt in the fishing community as well as in the Bay's water quality and ecology.

The Chesapeake Bay is not alone in its need for a healthy oyster population. Studies have indicated that South San Francisco Bay, a shallow estuary adjacent to a highly urbanized area, maintains its healthy condition in part because of a dense community of benthic filter-feeding organisms, including oysters.

For several years Cliff Love has been an avid oyster gardener with CBF. In fact, Love and his family started Restore the Oyster, a 120-member organization dedicated to promoting oyster gardening in the Virginia Beach area. Love became interested in oyster gardening when his son started an oyster project in high school. Living on the Lynnhaven River, a tributary of the Chesapeake Bay that has been banned from shellfishing because of high fecal coliform counts, the family felt the project was a natural outgrowth of their concern for the river. "My family loves oysters and we love the Lynnhaven River," says the Virginia Beach attorney, "so we started oyster gardening with CBF to protect the two things we really care about." The family believes that they and their neighbors can help clean up the Lynnhaven River if they restore the oyster population. Love now has four oyster floats under his private pier.

CBF has also teamed up with the Maryland Sea Grant Extension Program, the Oyster Recovery Partnership, and the University of Maryland Center for Environmental Science to establish the Oyster Alliance, a program that will help increase the number of oyster gardeners working in the Bay. Through a \$5,000 development grant, the University of Maryland Cooperative Extension has helped support the program, allowing it to produce training materials and set up a communications network. A web site developed by the Maryland Sea Grant Program will facilitate the recording of data on the growth and survival of the juvenile oysters. Participants will be able to compare the results of efforts in their areas and, eventually, track progress on the development of oyster reefs.

[For more information on oyster gardening or workshops in Maryland and Virginia, contact Stew Harris, Chesapeake Bay Foundation, 162 Prince George Street, Annapolis, MD 21401. Phone: (410) 268-8816. Or contact Julia Hardee at (757) 622-1964; e-mail: chesapeake@savethebay.cbf.org. More information is also available on CBF's web site at www.cbf.org/getinvolved/oystergardening.html.]

Oyster Gardening for Restoration and Education

This eight-page Oyster Alliance publication is a guide to getting started in the oyster gardening program. It provides basic information on setting up and maintaining oysters in floats or mesh bags, dealing with oyster predators, contending with oyster disease, and collecting growth and survival data. For a copy, call (301) 405-6376 or send an e-mail to: connors@mdsg.umd.edu.

States are Successfully Restoring Coastal Wetlands



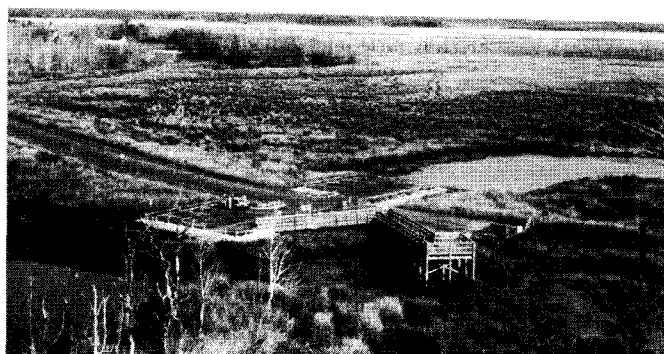
Coastal wetlands, the gateways between fresh and saltwater systems, are often hard hit by human activities. Nutrients, sediments, and other nonpoint source pollutants from the upper parts of coastal watersheds pool in coastal wetlands, while the economic value of coastal land makes it a target for development. These forces can combine to disrupt wetlands' ability to remove pollutants and moderate the effects of upstream flooding. However, federal and local agencies, industry, conservation groups, and the general public are successfully combining resources to reverse coastal wetland loss and degradation. A sampling of such projects follows.

New Jersey

More than 20,500 acres of degraded salt marsh and uplands along the Delaware Estuary in New Jersey and Delaware are the scene of one of the largest watershed restoration projects in the United States. Conducted by the Public Service Electric and Gas Company (PSE&G) through a permit from the New Jersey Department of Environmental Protection and an agreement with the Delaware Department of Natural Resources and Environmental Control, the project was conceptualized in 1990. PSE&G was under pressure to retrofit its Salem Generating Station, which borders the Delaware Bay in southern New Jersey, with cooling towers to address concerns about possible adverse impacts to fish populations.



Native marsh
vegetation is
returning to the
restoration site.
(right) before
restoration;
(below) after
restoration



The company proposed restoring the marsh as an alternative. Now, PSE&G's Estuary Enhancement Program strives to reintroduce the natural conditions that existed before human interference.

Another goal is to provide expanded habitat and food sources needed by aquatic organisms. The restoration involves opening dikes to restore tidal flow, eradicating *Phragmites australis* (an invasive plant species that can take over

disturbed wetlands), and allowing natural processes to complete the restoration. The company anticipates that full natural restoration of the site may take up to 12 years following completion of restorative construction, which is scheduled to end this year. [For more information, contact Marcia Walton, Communications and Outreach Coordinator, P.O. Box 236, Hancocks Bridge, NJ 08038. Phone: (609) 339-7915.]

Louisiana

In 1989, response to critical coastal land loss, Louisiana Department of Natural Resources launched a pilot project, partially funded by U.S. EPA, to test techniques for restoring wetlands in Cameron Parish, an area where sediment inflow was minimal. One technique, bay bottom terracing, uses existing sediment to form a baffle system of ridges or terraces at marsh elevation. A backhoe shovel mounted on a marsh buggy dredges to 1.52 meters below the shallow bay bottom. The dredged material is then placed on top of the adjacent bottom, forming a levee or terrace, the top of which is level with the marsh surface after settlement. The terraces are dredged on alternating sides to avoid creating continuous canals that can increase scouring. The technique was combined with breakwaters and revegetation to stabilize dunes or newly created dredged material. Engineering work was completed in 1990, and today, EPA's analysis of data collected from aerial photography, on-site surveys, and readings from satellite-linked data collection platforms show that the terraces are completely vegetated, shoreline retreat has been reversed, and annual primary productivity has increased. [For more information, contact Bill Good, Louisiana Department of Natural Resources, Coastal Restoration Division, P.O. Box 94396, Baton Rouge, LA 70804-9396. Phone: (225) 342-6028; fax: (225) 342-9417.]

New York

A critical salt marsh on the western shore of Staten Island and on the islands of Arthur Kill and Kill Van Kull in New York, damaged by a 567,000-gallon oil spill in 1990, is being restored by New York's City Park Foundation. Over 125 acres of salt marshes, mudflats, and tidal creeks were

heavily oiled, and a two-mile swath of unvegetated shoreline resulted from the spill. A legal settlement with Exxon Corporation garnered \$1.1 million to help fund the restoration work, which will be completed in October 1999. The work focuses on labor-intensive planting and monitoring of smooth cordgrass. A marsh plant that grows successfully in intertidal areas and stabilizes the shoreline against massive erosion, smooth cordgrass, also replaces lost habitat and accelerates the rate of reduction of petroleum contaminants. Volunteers from City Corps, Urban Park Rangers, college interns, professionals in related fields, environmental organizations, and individual citizens have contributed more than 4,000 hours, led by the Salt Marsh Restoration Team. Together, they have restored over one and one quarter miles of shoreline amounting to over six acres of primary mitigation for direct loss and two acres of secondary mitigation to compensate for loss of shoreline at impact sites. The team won the American Rivers 1997 Urban Hometown River Gold Award for Special Achievement in Scientific/Engineering Breakthroughs for their work on the project. [For more information, contact Carl Alderson, City Parks Foundation, New York City Parks-Greenbelt, 200 Nevada Ave., Staten Island, NY 10306. Phone: (718) 667-7477; fax: (718) 667-7477; web: www.amrivers.org/arthur.html.]

Notes on Watershed Management

Saving Life in Fresh Water? The Nature Conservancy's Freshwater Initiative

by Nicole Silk, Freshwater Learning Center, The Nature Conservancy



The Nature Conservancy, best known in the United States for working with willing private landowners to secure habitat for plants and animals, has been expanding its focus from protecting individual species to restoring entire functioning ecosystems. The organization sees a particular need for work in freshwater ecosystems, where many species are imperiled by water quality degradation and hydrologic alteration. In the United States, half of all wetlands and riverside ecosystems have been lost. In the remaining fresh waters, many species are at risk, including two-thirds of mussels, half the crayfish, and one-third of fish and amphibians.

To meet the many challenges of conserving freshwater biodiversity and to develop innovative new solutions, the Conservancy launched its Freshwater Initiative in 1998. The five-year program will build the Conservancy's skills, experience, and expertise with a goal of increasing freshwater biodiversity conservation in the United States, the Caribbean, and Latin America. Three strategies drive the Initiative: (1) identify the places that harbor critically important aquatic diversity; (2) find solutions to common causes of freshwater biodiversity decline; and (3) establish the Freshwater Learning Center to create new ways to share expertise and information on freshwater conservation within and outside of the Conservancy.

The Places

The Conservancy has identified over 30 sites across the Americas where the Conservancy is already involved in freshwater biodiversity projects and has grouped them into two networks to pursue solutions to either water quality degradation or hydrologic alteration. The sites focused on abating hydrologic alteration include places as diverse as Florida's Appalachicola River, Ecuador's Condor Bioreserve, the Illinois River in Illinois, Mexico's Cuatro Ciénegas, and southern California's Santa Margarita River. Equally diverse are the sites working to abate water quality degradation, including Ohio's Big Darby Creek, New York's French Creek, the Dominican Republic's Madre de las Aguas, Mexico's La Encrucijada, and the Conasauga River in Georgia and Tennessee. These sites are united not by geography, species, or political systems, but by common threats to their biodiversity.

Solutions

At sites addressing water quality degradation caused by runoff-related erosion and chemical pollution, the Initiative will help implement BMPs, including streambank revegetation, fencing cows out of streams, changing agricultural practices and crop types, using buffer strips, and even creating and restoring wetlands. The Conservancy foresees that a collaborative approach among landowners and government agencies will be essential in most of these places.

At the sites where hydrologic alteration is being addressed, the Initiative will help identify and implement strategies to reduce the flow changes caused by dams, water diversions, and ground water pumping. Changes to flow beyond the range of natural variability greatly impair the ability of many species to fulfill their life cycles and substantially reduce available habitat. For example, certain fish require specific flow timing, magnitude, and duration to trigger their spawning behavior and to provide adequate habitat. The challenge at these sites will be finding a balance between flows adequate for ecosystem health and human needs for irrigation, drinking water, and hydroelectric power. In some places, this may mean demonstrating that patterns of water extraction can be adjusted to meet both ecosystem and human needs.

Three tactics combine to make the Freshwater Initiative a unique approach. First, support staff and technical and scientific experts help site teams identify, develop, and implement the most effective strategies to abate the causes of freshwater biodiversity decline at their sites.

Second, through the Freshwater Learning Center, each site team benefits from frequent exchanges at workshops, over the internet, and through site visits among the network of similar Freshwater Initiative projects.

Third, rigorous attention is paid to monitoring design and implementation, encouraging experimental approaches that measure the ecological response to abatement strategies. Monitoring results are used to modify approaches at each site. The precise and accurate monitoring aids the development of solutions that are transferable to other sites.

Freshwater Learning Center

Accomplishing breakthroughs within five years will require that site teams build their own capacity through acquiring new skills. The newly established Freshwater Learning Center provides site teams with skill-building workshops and opportunities for education about technology and biodiversity conservation approaches. The Freshwater Learning Center will also make emerging solutions and lessons learned available outside the Initiative through educational products (including workshop proceedings, video, and computer media), articles in professional publications and news media, and presentations at conferences.

The Nature Conservancy's mission is to preserve the plants, animals, and natural communities that represent the diversity of life on earth by protecting the lands and waters they need to survive. The Nature Conservancy has the world's largest system of private nature sanctuaries, with 1,400 preserves in the United States alone. The Conservancy has protected more than 10 million acres in the United States and Canada and has worked with partner organizations to protect some 60 million acres in other countries. The Freshwater Initiative promises to build the organization's capacity and expertise with respect to water, while stemming biodiversity decline.

[For more information, contact Nicole Silk, Director, Freshwater Learning Center, The Nature Conservancy, 2060 Broadway, Suite 230, Boulder, CO 80302. Phone: (303) 541-0341; fax: (303) 449-4328; e-mail: nsilk@tnc.org]

Water, Winter, and Road Maintenance—Finding a Happy Compromise

In an average year, 13 million tons of salt are used in North America's snowbelt to keep winter traffic flowing. Come warmer temperatures, melt water can carry this salt to ground and surface water, raising the question of how to balance safe winter travel with protecting water resources. Many states and some local highway departments are switching to "anti-icing" techniques that use less salt, a change that is good for the water as well as the transportation wallet.

Anti-icing involves applying materials before precipitation to create a barrier that prevents ice and snow from bonding strongly to the pavement. The traditional method, de-icing, attempts to melt precipitation that has already bonded with the pavement. Anti-icing techniques make plowing easier and more efficient. Field tests funded by the Strategic Highway Research Program in 1993-1995 indicated that anti-icing is an appropriate snow fighting tool in temperatures above 18°F.

“Most states that have significant snowfall are using anti-icing,” says Salim Nassif, Winter Maintenance Program Manager with the Federal Highway Administration. The biggest obstacle to even more widespread use, especially at the local level, is technology transfer, Nassif notes.

Highway managers appreciate the fact that anti-icing can be cheaper than de-icing and seems to decrease the number auto accidents. A report by the University of Nevada compared anti-icing and de-icing and estimated that anti-icing saves \$325 million a year in service costs and avoids \$1.35 billion in property damage and delays. The environmental advantage is that anti-icing techniques use smaller applications of salt, sometimes a little as 20 percent of the average de-icing application.

Anti-icing techniques use the same compounds as de-icing, including liquid sodium chloride, liquid calcium chloride, liquid magnesium chloride, liquid calcium magnesium acetate, liquid potassium acetate, and some agriculturally derived products. Techniques involve either spraying anti-icing chemicals directly onto the roadway or pre-wetting sodium chloride to help it adhere to the pavement. Pre-wetting also helps initiate the chemical reaction and speed up the melting process.

Accurate local weather and pavement temperature information are musts for successful anti-icing, as is good timing. Most states now have weather information systems, including sensors in roads that provide pavement temperature and moisture readings that help time chemical application. Spreading anti-icing materials an hour or two before precipitation occurs is optimal—too late or too early can be wasteful.

Tweaking the Anti-icing Technique

Working together, Iowa State University and the Iowa Department of Transportation are raising anti-icing nearly to an art form. Their use of a brine, sprayed on roadways prior to ice storms, is cheaper, longer-lasting, and uses less salt. Typical spinner applications of dry salt waste nearly 30 percent, which bounces off the pavement. Even more is blown off by passing traffic. The city of Oskaloosa, Iowa, has taken the brine-spray technique one step further and designed a low-cost application system using salvage materials. Oskaloosa built the entire system for less than \$3,000 and estimates that the system paid for itself in reduced salt usage during two ice storms.

Roads vs Rivers?

To what extent do winter road maintenance materials cause water problems? The jury seems to be out on that question, but the extent certainly depends on the type and concentration of the pollutant, other potential stressors, weather conditions, and the size and type of the waterbody receiving the runoff.

EPA hopes to gather more information on salt's impact on ground water through future 305(b) reports. EPA's State Source Water Assessment and Protection Guidance, released in 1997, identifies salt storage sites as potential sources of both ground water and surface water sources of drinking water. States must identify significant potential sources of contamination within delineated source water protection areas.

Individuals with high blood pressure are particularly concerned about salt levels in their well water. Some have filed legal cases against town and state highway departments. Many of these individuals are now provided with bottled drinking water, and because ground water moves so slowly, such contamination could be a long-term problem.

An aquatic system like a stream, with the ability to flush quickly, would be less likely to suffer long-term problems. However, it is not unusual for streams to experience severe short-term salt loading when a thaw hits roadside snowbanks. In some cases, persistent elevated levels of sodium and chloride have been recorded in streams many months after salt is applied to roads.

Stream fauna appear to be fairly tolerant of short-term loadings. The Salt Institute's "De-icing and the Environment" cites research from the Department of Energy's Oak Ridge Laboratory showing that freshwater fish can tolerate from 7,500 to 10,000 ppm of salt, which, according to the Institute, is "far beyond any possible runoff of sensible roadway and bridge salting."

Trout, in particular, are surprisingly unaffected by a more saline environment, says New York State aquatic biologist Tim Preddice. "Diadromous fishes such as brown trout, rainbow trout, and Atlantic sturgeon are known for their ability to migrate between fresh and salt water for spawning. Evolution has provided these euryhaline species with a high tolerance to changes in salt concentrations. Stenohaline species such as many freshwater minnows and largemouth bass are less adapted to salt changes," Preddice explains.

Still, "there have been no fish kills in New York State during the last 30 years or so that have been attributed to road salt," Preddice says. "Road sanding is probably a greater threat to streams because much of it washes from roads during spring runoff. In streams, it can contribute to a 'blanketing effect,' smothering the substrate and rendering it less productive for benthic invertebrates."

Abrasives like sand that increase traction rather than prevent freezing have traditionally been part of the winter road maintenance arsenal. But abrasives' usefulness is short-lived because they are dispersed by traffic or covered with falling snow. Some urban areas where sand is heavily used follow quickly with street sweeping to cut down on air problems and reduce sediment loading to surface waters. State and local highway managers in the Denver, Colorado area are working to control the impacts of abrasives on stream and air quality.

"Dream Machine" Snowplow Combats Icy Highways and Polluted Runoff

Iowa, Michigan, and Minnesota are collaborating on the development of a new and improved snowplow. While the major purpose of the new snowplow is to make winter driving safer, the plow will also help highway crews reduce de-icing applications.

Each state first developed a prototype machine and tested its performance during the 1997-1998 winter season. All three vehicles were equipped with Global Positioning System antennae for sending data from sensors and equipment to computers at headquarters in real time every five seconds. Data include vehicle location and the condition of the road (temperature, ice coverage, and level of chemical). With this timely and accurate information, highway managers and plow operators can make decisions about what material (chemical or sand) should be applied and how much is needed for maximum safety. Matching the amount of de-icing material to the road conditions reduces the frequency and amount of chemicals applied, which in turn reduces the potential contaminants to surface water.

After the test period, the performance of the prototypes was evaluated and the design modified to assemble 10 vehicles for each state for further testing this winter.

[For more information, contact Susan Wallace, Iowa Department of Transportation, 800 Lincoln Way, Ames, Iowa 50010. Phone (515) 239-1314.]

A salt-related problem unique to small, deep waterbodies with limited flushing is prolonged chemical stratification that can prevent complete mixing during spring turnover and lead to anoxic conditions in deeper waters for up to eight or nine months. Also of concern is salt damage to vegetation, a well-documented problem that can indirectly affect surface water by killing roadside vegetation that filters highway runoff before it enters streams. Anti-caking agents containing cyanide mixed with salt may also pose a threat to aquatic life, although data on this effect are limited.

An Ounce of Prevention

Most experts agree that salt piles are the greatest threat to ground and surface water quality, making good storage practices and facilities critical. All anti-icing/de-icing material should at least be covered with tarpaulins or polyethylene. Specially designed roofed structures and impervious pads offer the best protection against contaminated runoff. Runoff should be collected in settling basins, and the brine that accumulates can be used for treating sand piles to avoid freeze-up. The pad site should be located away from wells, reservoirs, and ground water recharge areas. Proper calibration of spreaders is also essential.

New products and techniques for fighting ice are currently being created and tested. One such product, Ice-Ban, is a concentrated liquid residue from beer production. A team of experts from various sectors, including federal and state environmental agencies, are currently performing an environmental evaluation of this product. Results from lab tests focusing on BOD and nutrient content are due later in 1999.

As states and localities share information and experiences, progress toward an appropriate balance between safe roads and environmental health should accelerate. Says Dennis Burkheimer, winter operations administrator for the Iowa Department of Transportation, "We are striving to learn how to apply the right materials, in the right amounts, at the right time to provide safe winter roads for the traveling public."

[For more information, contact the Office of Environment and Planning, Federal Highway Administration, 400 7th Street, SW, Washington, DC 20590. Phone: (202) 366-2951. Or contact Dennis Burkheimer, Iowa Department of Transportation, Winter Operations Administrator, 800 Lincoln Way, Ames, IA 50010. Fax: (515) 239-1005. For more information on the environmental evaluation of Ice-Ban, contact Deb Snoonian, Project Manager, CERF, 1015 15th St, NW, Ste. 600, Washington, DC 20005. Phone: (202) 842-0555; email: dsnoonian@cerf.org; web site: www.cerf.org/evtec/eval/iceban.htm]

Agricultural Notes

Researching Economic Instruments for Nitrogen Control in European Agriculture

European Union member states are required by the Union's 1991 Nitrate Directive to have a voluntary code of good agricultural practices (for example, timing of fertilizer application and procedures for the land application of fertilizer and manure). They are also required to identify high-nitrate areas (called "vulnerable zones") where compulsory action to reduce levels will be enforced.

In Europe as in the United States, farmers, agronomists, policy makers, and water quality managers struggle to balance food production and water quality. The problems sound familiar: eutrophication resulting from runoff from agricultural activities, drinking water contamination, ozone depletion, and the greenhouse effect.

Henk van Zeijts is leading a team of six European research institutions that is studying economic alternatives for reducing nitrogen loads from agricultural runoff. Economic instruments have been used in Europe to finance farm subsidies and agricultural research, but not to regulate nitrogen input and output.

Van Zeijts thinks that levies on nitrogen could be ideal instruments for stimulating the efficient use of nitrogen, perhaps in combination with regulations. Such economic instruments could be designed to punish inefficient nitrogen use and leave the choice of on-farm measures to the farmer, who can choose the most cost-efficient measures. The money raised from levies could be put back into farming since nitrogen levies are not meant to lower farm profits but to achieve more efficient use of nitrogen, explains van Zeijts.

Begun in early 1997, the NITROTAX study is financed by the research department of the European Commission and by national governments. Coordinated by the Centre for Agriculture and Environment in the Netherlands, NITROTAX researchers are using a combination of farm model calculations, literature reviews, qualitative judgments, and expert opinions to answer the following questions:

- What are the technical, environmental, economic, and social implications of economic nitrogen control systems (i.e., systems based on levies and/or other economic instruments) in various European regions with different ecological, economic, and social conditions?

Economic Instruments for Nitrogen Control

Levy—government-imposed tax used to discourage suboptimal use of nitrogen (e.g., spills, overfertilization, or overfeeding).

Tradeable permit—permit that typically allows holders to sell or trade permits for the amount of nitrogen that leaves their system such that there is no net total increase in loadings. In a tradeable permit system, the amount of permitted pollution plays a central role as the regulatory stimulus. First, the amount of nitrogen pollution allowable is set at the national or regional level. Then an executive permit board sells tradeable permits for nitrogen loads.

Subsidy—government grant to an individual or company to promote a desired activity or achieve a desired outcome, such as reduced nitrogen loadings. Subsidies can be means-oriented (e.g., subsidies given for the implementation of a new environmentally friendly measure or package of measures) or goal-oriented (e.g., premiums on low nitrogen usage).

- Which systems offer the best prospects for implementing environmental and agricultural policy in the different regions and in the European Union as a whole?
- Do these systems comply with existing or anticipated agricultural and environmental policies and with international agreements? Are accompanying measures needed?
- At what level are coordination and legislation needed for these systems?
- What are the implications for European Union (EU) environmental policy and for the integration of environmental considerations in the Common Agricultural Policy. (The Common Agricultural Policy is a set of regulations by which members of the European Community—an entity within the European Union—seek to merge their individual agricultural programs into a unified effort to promote regional agricultural development, fair and rising standards of living for the farm population, stable agricultural markets, increased agricultural productivity, and methods of dealing with food supply insecurity.)

The economic systems being explored are tested on a broad range of criteria, including effectiveness and cost-efficiency; effects on technology, yields, and regional competitiveness; feasibility and fairness; and acceptability to farmers and other interest groups.

The study should provide an understanding of the pros and cons of economic systems for nitrogen control. It will help to determine the most suitable systems for application in the EU and in individual member states.

Preliminary findings have not yet been released, but it has already become apparent that the optimal economic instruments—levies, permits, or subsidies—will likely differ from state to state. Although some standardization is necessary to avoid unfair competition in the internal market, participants at a spring 1998 NITROTAX workshop concluded that varying environmental conditions and different societal preferences must be considered.

Reactions to economic instruments for nitrogen control also vary from region to region. According to van Zeijts, economic instruments for nitrogen control are under discussion in the United Kingdom. The government is investigating the possibility of implementation, but the farmers' union and fertilizer industries are against it. Discussion has also started in France. Economic instruments are already implemented in The Netherlands (tax on unallowable nitrogen surplus, tradeable manure quota, tradeable ammonia quota), Sweden (fertilizer tax), and recently in Denmark (fertilizer tax with exemption possibility). Finland and Austria abandoned fertilizer taxes after they entered the European Union. There is a fertilizer tax in Norway, outside the European Union. In southern Europe and Finland, parties seem more in favor of paying farmers for low-nitrogen intensity.

Acceptance by farmers depends on their farming situation, van Zeijts explains. "In areas with intensive animal production and high fertilizer use, farmers understand the need for policy measures."

Last year's workshop participants also discussed the best technical application point for economic instruments. Output or release to the environment seemed to be the best choice, but, says van Zeijts, measurement problems probably preclude that approach. Input, far less precise, is another alternative. Most participants favored the nitrogen surplus as the best point to apply economic instruments, but, again, regional differences may be an obstacle.

The study's concluding conference will be held March 22 in Brussels.

[For more information, contact Henk van Zeijts, Centre for Agriculture and Environment, P.O. Box 10015, NL - 3505 AA Utrecht, The Netherlands; e-mail: hvzeijts@clm.nl. Note: The text of the EU Nitrate Directive is available at www.unimaas.nl/~egmilieu/Legislation/NITRAAT.HTM]

Typical Measures to Reduce Nitrogen Loss

- ✓ Reducing the fertilization level
- ✓ Improving grassland management (higher quality, larger net yield)
- ✓ Disposing of animal manure, in the case of intensive animal farms
- ✓ Changing cropping patterns to less nitrogen-intensive crops
- ✓ Lowering the number of animals on the farm (e.g., a farmer lets other farmers raise his calves on their farms)
- ✓ Lowering the nitrogen content in animal feed
- ✓ Spreading manure at proper rates and seasons and substituting manure for commercial fertilizer at appropriate levels.

EPA and Pork Producers Agree to Voluntary Compliance Initiative to Protect America's Waters



As part of President Clinton's Clean Water Action Plan, the U.S. Environmental Protection Agency and the National Pork Producers Council (NPPC) have established a voluntary compliance program to reduce environmental and public health threats to the nation's waterways from runoff of animal wastes from pork-producing operations.

Under this initiative, announced November 25, 1998, participating pork producers will have their operations voluntarily assessed for Clean Water Act violations by certified independent inspectors. Producers who promptly disclose and correct any violations discovered by these audits will receive a much smaller civil penalty than they might otherwise be liable for under the law.

"This program is an example of government and industry working together to find common-sense solutions to protect public health and the environment," said EPA Administrator Carol M. Browner. "President Clinton has pledged to finish the job of cleaning up America's waterways through his Clean Water Action Plan, and today we are taking another step to help make good on that pledge by controlling runoff from animal feeding operations, a major source of water pollution. The National Pork Producers Council is to be commended for working with us to address one of our nation's most serious environmental problems."



The Clean Water Action Plan, which is the Administration's blueprint for completing cleanups of our nation's rivers, lakes, and streams, has identified polluted runoff from industrial feeding operations as a leading source of water pollution. In conjunction with the Clean Water Action Plan, EPA and the U.S. Department of Agriculture announced a draft joint animal feeding operations strategy to control agricultural animal waste runoff. The amount of animal manure and wastewater generated from animal feeding operations can pose risks to water quality and public health. Potential impacts include the absence of or low levels of dissolved oxygen in surface water, harmful algal blooms, fish kills, and contamination of drinking water from nitrates and pathogens. Excess nutrients in water also may result in outbreaks of microbes such as *Pfiesteria piscicida* found in the Chesapeake Bay and in North Carolina.

The compliance audit program provides an incentive for pork producers to take the initiative to find and correct Clean Water Act violations and prevent discharges to waterways without compromising the ability of EPA or states to enforce the law. Pork producers who undergo the assessment and promptly report and correct violations will receive seals of approval from the NPPC.

The NPPC, a national association representing all pork producers, plans assessments for more than 10,000 pork production facilities. NPPC developed the assessment program at a cost of \$1.5 million and will fund the training of independent inspectors and the program's oversight. EPA has provided a \$5 million grant to America's Clean Water Foundation to assist with the assessments.

The compliance audit program does not extend to slaughterhouses, pork-processing and packing facilities, or other ancillary operations. EPA will consult closely with the states in implementing the compliance audit program. States may elect to administer the program directly, in which case EPA will refer any disclosures to the states for consideration and response.

[The strategy is on the web at es.epa.gov/oeca/ore/porkcap/index.html or see EPA's National Agriculture Compliance Assistance Center web site at www.epa.gov/oeca/ag. For more information, call toll-free (888) 663-2155.]

Food Companies Become New NPS Champions

New clean water champions are emerging from the hub of the food production industry. Food processors and merchandisers are finding creative ways to work with growers to reduce pesticide usage, cut nitrogen applications, promote soil conservation and, in some cases, even restore degraded riparian zones. They are using a variety of tools to convince the farmers they work with to adopt nonpoint source control practices. These tools range from simply making information available to growers or encouraging voluntary BMP implementation, to requiring strict compliance with specific management measures.

At the "softer" end of the spectrum is the Lodi-Woodbridge Wine Grape Commission, a giant in the wine-grape industry. Lodi-Woodbridge encourages integrated pest management (IPM), drip irrigation, use of compost instead of chemical fertilizers, and cover crops. A grower cooperative, Lodi-Woodbridge uses bulletins, meetings, and workshops to provide information about these practices to growers. Lodi-Woodbridge also funds research and runs a demonstration vineyard.

Horizon Organic Dairy, the largest marketer of organic milk products with 125 participating dairies in Iowa, Pennsylvania, and Wisconsin, goes further and provides its producers with field services and counsel to reduce nonpoint source pollution.

Other organic food companies, as well as some that market conventionally grown foods, are discovering that economic measures help enable farmers implement certain practices. These companies pay producers a premium to adhere to practices like IPM or nutrient management. Some help farmers pay for installing BMPs.

For example, Butterball, a poultry company, builds on its technology transfer activities with a program that pays its new operations a 25 percent rebate for installing the poultry mortality composting units that it requires. Motivation for the program comes, they say, from a desire to get

ahead of the curve of potential future regulations as well as real concern for protecting the environment.

Similar concerns led Draper Valley Farms, another poultry company, to require its 35 producers of broiler chickens in Washington state to refrain from disposing of dead birds in pits and storing uncovered poultry litter onsite. Draper supports composting as an alternative and finds that its producers, who generally do not have enough land for land application, are composting manure and marketing it off-farm.

The American Crystal Sugar Company has designed a quality payment program as an incentive to growers to increase sugar production through the use of BMPs, including nitrogen management. This works to reduce nitrogen application because beets, like wine grapes, are actually of higher quality when nitrogen is not over-applied.

One of the most comprehensive food company programs to promote nonpoint source control is that of Murphy Family Farms, which supports 700 hog operations in the Midwest and North Carolina. The company helps new farmers write nutrient utilization plans, conducts weekly environmental assurance inspections of all farms, requires soil testing, provides dumpster and free pickup service for swine mortalities, and requires growers to attend an environmental training course and to report weekly on their remaining capacity in manure-holding lagoons. These strict requirements are supported by an array of technology transfer, research, and stewardship activities.

As food companies and other industries realize their tremendous potential to improve water quality, efforts like these will become more common. EPA has compiled information on 40 food companies that exert a positive influence on the environment in a report called *Food Producers and Environmental Stewardship: Examples of How Food Companies Work with Growers*.

[For more information, contact Richard Kashmanian, U.S. EPA, Mail Code 2129, 401 M St., SW, Washington, DC 20460. Phone: (202) 260-5363; e-mail kashmanian.richard@epa.gov. To order a free copy of *Food Producers and Environmental Stewardship: Examples of How Food Companies Work with Growers*, contact NCEPI, 11029 Kenwood Rd., Bldg. 5, Cincinnati, OH 45242. Phone: (513) 489-8190; fax: (513) 489-8695.]

Changing the Minds, and Behavior, of Wisconsin Potato Farmers

Wisconsin potato growers have significantly reduced their use of high-risk pesticides, thanks to a collaborative project with the World Wildlife Fund (WWF) and the Wisconsin Potato and Vegetable Growers Association (WPVGA). The project promotes biologically based pest management practices that reduce risks to human health, as well as reliance on synthetic pesticides.



A WWF study showed that more than half of the pesticides used in the Great Lakes Basin pose serious threats to humans, wildlife, and the environment. According to WWF, reliance on highly toxic pesticides could be significantly reduced through increased adoption of biologically based integrated pest management (IPM). The study also found that farmers who use fewer pesticides are able to increase their profits without reductions in crop yields.

High Hopes

In October 1996, WWF and WPVGA, which represents more than 250 Wisconsin farmers growing potatoes on 80,000 acres, signed a Memorandum of Understanding setting targets for drastically reducing the use of certain chemicals they deemed "highly toxic." The two organizations found common ground for their effort in the need for safe food, safe farming, and enhanced wildlife habitat. They also share a interest in developing mechanisms to gain marketplace advantages for growers using IPM.

To help farmers select the appropriate pesticides, the organizations supported development of an index that incorporates the environmental and public health impacts of pesticides into a single assessment tool. Project scientists used the index to calculate a "toxicity factor value" for all pesticides used in potato production, identifying 11 as high risk. The composite values allow

Changing the
Minds, and
Behavior, of
Wisconsin Potato
Farmers
(continued)

comparisons of active ingredients on a pound-for-pound basis. Researchers calculate toxicity units by multiplying the pounds applied of each pesticide by the pesticide's toxicity factor value.

Hitting the Target, and Then Some

In the two years since the collaborative effort began, Wisconsin potato growers have voluntarily cut their use of the 11 high-risk pesticides, achieving a 25 percent reduction in the toxicity units associated with these pesticides. Across all pesticides used on potatoes in the state, toxicity units declined by 20 percent, even though nationwide, the trend was up (pesticide toxicity units rose 16 percent in other major potato-producing states). In addition, toxicity units associated with insecticides were reduced by a remarkable 61 percent in Wisconsin from the 1995 baseline.

Active Ingredients Subject to WWF/WPVG Pesticide Risk Reduction Goals

Insecticides

Methamidophos
Azinphos-methyl
Carbofuran
Oxamyl
Endosulfan
Permethrin

Fungicides

Mancozeb
Chlorothalonil
Maneb
Triphenyltin hydroxide

Herbicide

Metribuzin

Reducing Reliance on Pesticides in Great Lakes Basin Agriculture

by Polly J. Hoppin, Richard A. Liroff,
and Michelle M. Miller

Published in 1997 by the World Wildlife Fund, the report outlines economically feasible alternative practices for farmers who reduce reliance on highly toxic pesticides. The book is based on a review of pesticide use in the Great Lakes basin, but serves as a resource for agricultural pollution prevention nationwide. The cost of the book is \$16.50. To order, use the World Wildlife Fund's order form at www.wwf.org/pubs/catalog98/form.html or call (410) 516-6951.

The memorandum of understanding's three-year acute risk reduction goal (acute-risk pesticides are those deemed extremely hazardous) set for the 1999 crop season calls for a 50 percent reduction in toxicity units. The three-year goal for chronic-risk pesticides (those posing a long-term risk) calls for a 30 percent reduction from the 1995 baseline. The five-year goal calls for the use of acute-risk and chronic-risk pesticides to be phased out or for no detectable residues by the end of crop season 2001.

Government Agencies Share the Burden

This year, WWF and WPVGA received \$250,000 in government grants through several USDA agencies and EPA's Pesticide and Environmental Stewardship Program. "This funding reflects the public's interest in pesticide risk reduction and the importance of a multi-stakeholder approach to finding alternatives to high-risk pesticides," said Sarah Lynch, project officer for WWF. "Our collaboration is proof that a proactive commodity group like WPVGA can work with a nature conservation organization like WWF to achieve significant reductions of high risk pesticides without driving farmers out of business."

[For more information, contact Sarah Lynch, Senior Program Officer, World Wildlife Fund, 1250 24th Street, NW, Washington, DC 20037-1132. Phone: (202) 778-9781; fax: (202) 530-0743; e-mail: sarah.lynch@wwfus.org.]

Technical Notes

Nitrogen-laden Rocks Contribute to High Levels of Nitrate in California River

Human activities are normally blamed for nutrient overenrichment in streams and rivers. But in one nitrogen-plagued river in California, they are not the only culprits. According to a study by researchers at the University of California, Davis (UC Davis), naturally occurring bedrock may be an unusual additional source of nitrates in the Mokelumne River watershed.

The Mokelumne River watershed spans 592 square miles southeast of Sacramento. The predominant land uses, timber harvesting in the upper watershed and rotational grazing in the lower watershed, are known to increase nitrogen runoff to area waterbodies. Indeed, several reservoirs downstream of the Mokelumne River have experienced significant eutrophication from high nitrate levels, resulting in periodic fish kills as a result of hypoxic conditions caused by the decomposition of nitrate-induced algae blooms. But hydrology doctoral candidate JoAnn

Holloway at UC Davis and her advisor Randy Dahlgreen wondered if something else was also contributing to the high nitrate levels. In a paper published in the October 1998 issue of the journal *Nature*, Holloway reported an unexpected source of nitrogen loading to the river.

Holloway and her colleagues collected water samples from 35 streams throughout the watershed and compared their nitrate levels with a geologic map of the area. They noted a close correlation between high-nitrate streams and bedrock containing metasedimentary and metavolcanic rock—rock that has undergone physical changes as a result of high temperatures and pressures. The scientists compared the nitrogen concentrations in the various types of bedrock in the streams. They found that the nitrogen concentrations in the metasedimentary and metavolcanic rock in the lower watershed's streams were much higher than concentrations in the igneous rock from streams in the upper part of the watershed. Holloway reported that "the upper watershed has 90 percent of the watershed area and a nitrogen flux of 0.12 kg of nitrogen per hectare per year; while the lower watershed has 10 percent of the watershed area with nitrogen fluxes of 10-20 kg of nitrogen per hectare per year." According to Holloway, greater than 90 percent of the nitrate in the streams originated from the lower part of the watershed.

High-nitrate metavolcanic and metasedimentary rocks begin as volcanic material and ocean sediments, say the researchers. Over time, nitrogen-rich organic material settles and is incorporated into bedrock. Weathering releases the nitrogen and elevates in-stream nitrogen, especially during the early fall and winter when early rains flush out nitrogen that has weathered from the rocks over the summer, the scientists say.

"We believe, on the basis of our investigation, that release of geological nitrogen contributes to nitrogen saturation of these ecosystems, leading to elevated streamwater nitrate concentrations," Holloway and her colleagues concluded. The study is the first to demonstrate the role of geological nitrogen as a source of nitrate contamination to surface waters.

What can be done about the problem? Holloway says, "The best land-use approach is to understand that nitrogen is released from nitrogen-bearing bedrock and that we must carefully plan future developments accordingly."

[For more information, contact JoAnn Holloway, Department of Land, Air and Water Resources, 235 Hoagland Hall, University of California, Davis, CA 95616-8627. Phone: (530) 752-3073; email: jmholloway@ucdavis.edu.]

State-of-the-art Street Sweeper Could Reduce Suspended Solids in Receiving Waters



In a recent "sweep-off" in Northern Virginia, a new generation dry street sweeper out-performed a conventional wet sweeper in picking up fine particles that contribute to water quality problems in Lake Barcroft, a small urban reservoir with silting problems.

Answering the need to remove very small particles, called fines, from road and airport runway surfaces, manufacturers have developed a street sweeper that operates more like a giant vacuum cleaner than a rotary push broom.

The traditional "wet" sweepers that pick up trash, gravel, sand, and miscellaneous litter gave street sweeping a bad name in the 1980s, when EPA's National Urban Runoff Program concluded that wet sweepers may do more harm than good. EPA found that the wet process picks up gross contaminants but actually rebroadcasts fine material, which may contain heavy metals and nutrients, while simply wetting down the dust that is left. The street looks a lot cleaner, but the dust that remains is washed into surface waters with the next rain.

The new type of sweeper blasts the streets with dry air that is collected and filtered to less than 3 microns before discharge. The fine particles are trapped for disposal. According to the manufacturer, independent tests conducted in Oregon and Washington showed that the dry sweeper removed 99.6 percent of all particulates over 10 microns, and once a week sweepings resulted in a 76 percent reduction of suspended solids in downstream receiving waters.

The sweep-off in the Lake Barcroft watershed was funded in part by a section 319 grant for identifying and demonstrating BMPs appropriate for use in older urban areas. The Lake Barcroft Watershed Improvement District chose a 2.65 mile stretch of Sleepy Hollow Road for the study. Pitted against each other were two sweepers—a wet sweeper currently used by Virginia Department of Transportation and the new type dry vacuum sweeper.

The sweepers simultaneously swept opposite sides of Sleepy Hollow Road, then switched and swept the other sides. On the first sweep, the wet sweeper picked up 2,160 pounds (with weight of water subtracted) and the new type picked up 2,700 pounds. On the second sweep, the wet sweeper picked up 210 pounds and the new type picked up 1,080 pounds.

Analysis showed the new type removed 6.75 pounds of total phosphorus, compared with 1.08 pounds removed by the wet sweeper on the first sweep, and 2.59 pounds on the second sweep compared with 1.14 removed by the wet sweeper.

While clearly outclassed by the competition under the circumstances, the older wet sweeper is not all bad. It does a good job picking up trash and large particles such as sand and grit, which could be reused when streets ice.

The new type sweeper did not remove large objects as efficiently as the wet sweeper, the study found. In the best of worlds, a wet sweeper could sweep ahead of the new type sweeper, picking up both larger debris and finer particles.

[For more information, contact Stuart Finley, Operations Director, Lake Barcroft Watershed Improvement District, 3428 Mansfield Road, Falls Church, VA 22041. Phone (703) 820-7700, or Vern Hines, Schwarze Industries, Inc., P.O. Box 26, Godfrey, IL 62035-0026. Phone (618) 782-6240.]

Improved Irrigation Systems to Protect Ground Water

by Monica Manton Norby (Reprinted from *Research Nebraska!*, April 1998.
University of Nebraska-Lincoln)

Corn in the Central Platte Valley grows tall and lush, fed by nitrogen fertilizer and water pumped from the aquifer 18 feet below the fertile silt loam soil. Irrigation is a way of life here, learned over decades of watering furrows between corn rows running the length of flat fields. This bounty has a cost: almost 500,000 acres in this valley lie over ground water that exceeds the safe drinking water standard of 10 parts per million (ppm) of nitrate-nitrogen. A major culprit: nitrates leaching from the crop root zone into ground water, a process accelerated by inefficient irrigation practices.

In 1990, the U.S. Department of Agriculture initiated and funded five regional projects, called Management Systems Evaluation Areas (MSEA), to develop improved cropping systems to protect ground water quality. Nebraska University's Institute of Agriculture and Natural Resources (IANR) and USDA-Agricultural Research Service researchers cooperated on Nebraska's MSEA project, which included a 320-acre large-field study and more than 25 small-plot research projects.

"What we found in our large fields is that water is the driving force in nitrogen management. Until we do a good job of managing water from rainfall and irrigation we're really limited in how we can manage nitrogen," said Jim Schepers, USDA-ARS soil scientist at the University of Nebraska who co-led the MSEA project with Darrell Watts, IANR biological systems engineer and Roy Spalding, associate director of University's Water Center/Environmental Programs.

Watts agrees that water management is important during the growing season, but MSEA research found that the amount of nitrogen applied also is key. "Unless nitrogen amounts are more carefully tailored to meet crop needs, excess nitrogen can still leach into ground water during the fall and spring," Watts said.

The MSEA site near Shelton offered three field-sized, 33-acre research blocks, planted to continuous corn, to compare different management systems and their impact on ground water. Nitrate levels under the fields were 32 ppm at the project's beginning. Forty-one wells with various sampling depths allowed accurate water sampling for nitrate, atrazine, and other contaminants.

MSEA researchers compared a field using conventional furrow irrigation and preplant fertilizer and herbicide applications to two improved systems: surge irrigation with improved nitrogen management and sprinkler irrigation with improved nitrogen management. Improved nitrogen management practices included reduced preplant fertilizer applications and fertigation, or supplying nitrogen fertilizer through the irrigation system. Researchers scheduled fertigation based on chlorophyll meter readings indicating plant nitrogen needs.

In the sprinkler irrigation block, "spoon feeding" of small amounts of nitrogen reduced the amount applied and increased nitrogen-use efficiency. "After several years of sprinkler irrigation with improved nitrogen management, the water leaving the bottom of the crop root zone was approaching the safe drinking water level of 10 ppm," Schepers said.

MSEA well-monitoring data are still being analyzed, but preliminary results indicate a trend toward less contaminated ground water under the sprinkler system, Spalding said. "The most important thing we have seen is the tremendous value of long-term ground water monitoring," he said. Nitrate and pesticide concentrations in water can fluctuate so greatly year-to-year that Spalding and colleagues monitored the MSEA site once more in 1997 to see if their assessments hold up.

Sprinkler irrigation is both the most efficient and most expensive way to irrigate and reduce nitrogen use. Watts and Dean Eisenhauer, IANR biological systems engineer, used surge irrigation as a less expensive approach. Surge irrigation uses computer-controlled valves to apply water more uniformly along furrows. They were able to apply less than half as much water as conventional furrow irrigation while maintaining corn yields. "We developed a feedback control system using sensors in the field that tell what the soil conditions are right now," Eisenhauer said. "This allows irrigators to manage the amount of water they apply much more efficiently," he said.

Getting the message about nitrogen management out to producers was an important element of MSEA, said Derrel Martin, IANR biological systems engineer who studied irrigation management. Education efforts by University Cooperative Extension, the Natural Resource Districts, and the Natural Resources Conservation Service demonstrating more efficient furrow irrigation systems to area producers helped reduce the total water applied on more than 273,000 acres in the MSEA target area by 10 percent, Watts said. These efforts also helped decrease the average nitrogen application rate by 20 percent over the last 10 years, he said.

Although MSEA funding officially ended in 1996, potentially valuable technologies continue to spin off from MSEA projects. Among the most promising are systems using tractor-mounted remote sensors to control variable rate and spot fertilizer treatments, and using remote sensing to scout fields for problem areas.

[For more information, contact James Schepers, USDA-ARS, 113 Keim Hall, University of Nebraska-Lincoln, Lincoln, NE 68583-0915. Phone: (402) 472-1513; fax: (402) 472-0516; e-mail: jscheper@unlinfo.unl.edu.]

Applying a Watershed Model to Reduce Nonpoint Source Runoff



A model that combines physical environmental inputs and financial information is helping communities and agricultural producers in four Missouri watersheds make some tough decisions. The model—actually a combination of several models—illustrates the consequences of altering agricultural production practices to protect drinking water reservoirs.

Development of the decisionmaking tool was sparked by elevated levels of agricultural chemicals (atrazine in particular) and sediments in drinking water reservoirs in a number of towns and cities throughout Missouri.

In the Cameron watershed, 40 miles north of Kansas City, Missouri, results from the model led Cameron's city manager to estimate that he could save \$50,000 a year in water treatment costs by getting farmers to reduce nitrogen, cut atrazine application, or replace atrazine with an alternative herbicide. As a result of the findings, to help farmers make management changes, the local soil and

water conservation district provided multi-year planning assistance. The analysis also determined annual cost-share incentives offered by the district to offset changes in net farm income as a result of implementing certain management practices.

Beginning in 1994, the Missouri Food and Agricultural Policy Research Institute (FAPRI) at the University of Missouri investigated the use of models to advise and educate agricultural producers and communities about solutions to water quality problems. What evolved is the combination of models that track the fate of environmental inputs and the financial implications of various production practices at the farm level. Bridged by software developed by FAPRI, the output of these models from all watershed farms is fed into a watershed-level model that indicates loadings to the receiving waters. The process enables producers to understand how practices on their farms affect drinking water supplies and the costs associated with various practices to reduce polluted runoff.

■ **EPIC, the Erosion Productivity Impact Calculator**, is a field-level, physical-process model that tracks the environmental performance of a field in agricultural production. The model receives input on properties such as soil type, slope, and any structures that are present on the field. The system uses climatic information including daily rainfall and temperature from local weather stations. The nutrient components of animal manure—nitrogen and phosphorus—and any agricultural chemicals applied to a field are also entered into the system. Output from the model includes information on soil erosion and degradation of the soil profile through time. The model also makes it possible to track the movement of fertilizers and agricultural chemicals that move off the field in either surface flow, sub-surface runoff, or percolation through the soil.

■ **FLIPSIM**, another farm-scale model, focuses on the economic behavior of a farm in response to various farming practices. Production costs, farm machinery, the size of the operation, planting practices, and fertilization procedures feed the model. Output includes information that aids the farmer in decisions about production targets, debts, taxes, buying and selling land and equipment, and building structures. This financial information can be projected over 10 years based on data from the U.S. Agricultural Outlook, a report developed by a FAPRI consortium that predicts crop and livestock production economics.

The key to the success in applying these two models is a panel of five agricultural producers that use a consensus approach to construct financial and production information about a representative farm in their area. The panel develops several alternative production scenarios to feed into the models. They can choose those practices that not only maximize environmental benefits but also keep costs in check. Local producers can immediately see the costs associated with various farming practices.

■ **SWAT — Soil Water Assessment Tool**. To determine the effects of agricultural production on a watershed scale, the combined outputs from EPIC and FLIPSIM are fed into another model called SWAT. SWAT takes the runoff information from the edge of the watershed farms and moves it into receiving waters. By inputting different production data suggested by the producers, the model predicts the fate of agricultural chemicals, soil erosion information, and the associated economic implications for the farms.

Based on the model's results, farmers can make informed decisions that reduce soil loss and, in many cases, lower production costs by reducing overall chemical application. Farmers also gain a greater understanding of the costs associated with alternative production strategies, while the community wins by lowering water treatment costs.

[For more information, contact Russ Mills; Food and Agricultural Policy Research Institute, Agricultural Economics, 101 South 5th St., University of Missouri, Columbia, MO. Phone: (573) 882-1928.]

Notes on Education

Texas Forest Service Teaches Loggers about BMPs and Water Quality

In the piney woods of East Texas, more than 1,000 loggers and foresters have attended BMP training workshops conducted by the Texas Forest Service. More than 40 workshops have been held and thousands of landowners have received technical assistance through the award-winning project.

Loggers who complete the training receive a "Pro-Logger" Certificate. The certificate enables them to sell wood to mills that participate in the American Forest and Paper Association's Sustainable Forestry Initiative. As Initiative participants, these mills purchase wood only from loggers with Pro-Logger status.

Training includes discussions, videos, and slide presentations about such BMPs as streamside management zones, waterbars, wing ditches, and revegetation. Loggers in the training workshops get the chance to observe on-the-ground BMP applications. Other topics include silviculture, wildlife, endangered species, wetlands, and logging safety.

"We're moving ahead with our outreach program, which emphasizes clean water and continuing education," comments Texas Forest Service Forester Larry Clendenen. "Moving ahead" is an understatement. The training program has been an unequivocal success. Ninety-eight percent of all forest industry property owners and about three out of four non-industrial private forest landowners apply the BMPs. The Texas Forest Service estimates that, each year, the BMP project helps prevent an estimated 11,500 tons of sediment from entering East Texas streams.

The response from workshop participants has been overwhelmingly positive, too. Ninety-seven percent of the loggers, foresters, and others who have completed the workshop said they would recommend the training to others. Furthermore, participants agree that logging contractors, crews, timber company management, supervisors, foresters, county commissioners, and local governments should all be involved in the workshops.

And since a significant number of absentee landowners reside in urban areas in central Texas, the Texas Forest Service has made it easier for them to get training by offering workshops in other areas throughout the region.

Although the BMP project currently focuses on just two East Texas counties, Angelina and Nacogdoches, the Texas Forest Service is planning an intensive educational outreach program in the Cypress Creek watershed, and is working with non-traditional cooperators like county commissioners, county road developers, and others.

[For more information, contact Larry Clendenen or Burl Caraway, Texas Forest Service, P.O. Box 310, Lufkin, TX 75902-0310. Phone: (409) 639-8795.]

Educational Resources Column

Watershed Educational Materials Catalog

Do your neighbors know what a watershed is all about and how they affect its condition? If you're organizing a watershed protection group, or you want to give information to your city council or your kid's school—you'll find what you need in Terrene's *Environmental Products Catalog*. Here is a sample of its contents:

- Watershed series posters: nine colorful posters showing problems and sound management practices
- *Taking a New Tack on Nonpoint Water Pollution*: final, full report of the National Forum on Nonpoint Source Pollution.
- *Clean Water in Your Watershed: A Citizen's Guide*: a guide to designing and completing a watershed project.

- EnviroScape®: a hands-on, portable watershed model that vividly shows how what we do on the land affects water quality. A Landfill EnviroScape is also now available.

[For the complete catalog, contact Terrene's Order Dept., P.O. Box 605, Herndon, VA 20172-0605. Phone: (703) 661-1582; e-mail: terrinst@aol.com; web site: www.terrene.org.]

Video—*The Clinch Valley: Saving Our Last Great Place*

This 16-minute video tells the story of the rare natural resources of Clinch Valley, Virginia, and the efforts of local citizens, such as those in Russell County and St. Paul, to protect their environment while improving their economy. Produced by The Nature Conservancy, copies are available for viewing by community groups.

[To borrow a copy, contact Rob Riordin, The Nature Conservancy, Virginia Chapter, 1233A Cedars Court, Charlottesville, VA 22903-4800. Phone: (804) 295-6106]

Reviews and Announcements

Buffer Directory Under Construction

The NICOLAS (Nutrient Control by Landscape Structures) Research Project conducted by the European Commission is compiling a database directory of buffer zone projects. Researchers are looking for descriptions of projects involving the function of buffer zone habitats and their attenuation capacity of energy or materials.. Research, demonstration projects, designs, and these are welcome.

To enter information, access www.qest.demon.co.uk/nicolas/nicdata.htm. All information will be in the public domain and in early 1999, NICOLAS will use the data to construct a directory on the Internet.

[For more information, contact Quest Environmental, St. Albans, Herts, AL4 0RB, UK. Phone: 44 (0) 1727 852665; fax: 44 (0) 1727 866181; e-mail: nehaycock@qest.demon.co.uk.]

EPA Releases Research Strategy for Ecological Risks

EPA's Office of Research and Development has completed its *Ecological Research Strategy*. The report outlines EPA's long-term goals and objectives for ecological research to better understand and manage risks to ecosystems. The report describes research plans for important environmental stressors and problems such as mercury, nitrogen, pesticides, global climate change, and algal blooms. Much of the ecological research will be in high-priority geographical areas such as the Chesapeake Bay, the Everglades, the Great Lakes, and the Gulf of Mexico. The strategy is one of a set that EPA is preparing to guide its research on important human health and environmental issues. Other completed strategies address research topics such as drinking water and endocrine disruptors. Copies of the strategies can be obtained through the Internet at www.epa.gov/ord/WebPubs/final/.

[Printed copies are available from ORD's Center for Environmental Research Information. Phone: (513) 569-7562.]

Cannonsville Reservoir in New York Featured in Special Issue of Journal

The North American Lake Management Society (NALMS) recently published a special issue of their *Lake and Reservoir Management* journal featuring the Cannonsville Reservoir in New York. The journal includes 22 technical articles summarizing scientific and related modeling efforts for the Cannonsville Reservoir. This reservoir is the third largest, and one of the most eutrophic, of 19 water supply reservoirs operated by the New York City Department of Environmental Protection. EPA's Watershed Branch provided support to NALMS under a cooperative agreement to print and distribute additional copies of this journal.

[If you would like a copy of this journal, contact Jeff Gratz, U.S. EPA Region 2, 299 Broadway (25th Floor), New York, NY 10007-1866. Email: gratz.jeff@epa.gov.]

National Directory of Volunteer Environmental Monitoring Programs Released

The fifth edition of the *National Directory of Volunteer Environmental Monitoring Programs* has been released. It provides highlights of 772 volunteer programs around the country engaged in monitoring conditions in streams, lakes, estuaries, ground water, coral reefs, wetlands, beaches, and surrounding land areas.

This directory chronicles the continuing growth of volunteer environmental monitoring. More programs than ever before are included for every state in the nation. More than 460,000 volunteers are performing biological studies, carrying out basic chemical water quality tests, studying the physical condition of waters, and looking at the public health implications of pollution. Volunteers are also cleaning up debris, restoring degraded habitat, and engaging their local communities in water quality-related educational activities.

Volunteer data are used by the programs themselves, by community organizations, and by state, federal, and local governments for a wide variety of purposes. Community education is clearly the number one use of volunteer data, followed closely by establishing baseline water quality conditions, and screening for pollution problems. Over half the programs in the directory include classroom teachers and their students in monitoring activities.

[For a copy of the directory, contact EPA's National Center for Environmental Publications and Information (NCEPI) at (800) 490-9198. The directory is also available on EPA's volunteer monitoring web site at www.epa.gov/owow/monitoring/vol.html.]

Reflections

A Funny Thing Happened on the Way to the Prairie . . .

by Greg David, Prairie Dock Farm, Watertown, Wisconsin

An interesting thing happened on the farm the other day. We received two inches of rain in about 25 minutes. Water poured off the pig yard. With the water went who-knows-how-much of the compost the pigs help us work. Water also rushed off the neighboring half square mile, carrying its load of silt and who-knows-what else.

All that runoff flows through the lower five acres on our farm, where, in the past, someone built a swale to channel the waters quickly and efficiently to the river.

This is where we chose to put a prairie restoration 10 years ago. Now the grasses are taller than a man on horseback can reach, and the forbs that have been blooming since May have topped out at 14 feet (thus, our farm's namesake, the prairie dock). It is a lush, wild place, teeming with life and adventure. Yesterday as I walked through it, unable to see more than a few feet ahead, I was reminded of what it must have been like in the old days when pioneer mothers warned their children to "stay out of the prairie; you'll get lost and never find your way back!" Then a car whipped past at 60 mph, and I was shaken from a daydream of a time long past.

But that lush, looming growth of the prairie still has its place on our farm. Knowing that down-pours like the one last week occur in nature (and they seem more and more frequent and severe), we decided to put the prairie where we thought it would do the most good. Now it acts like a giant living sponge, intercepting our occasional runoff problems, as well as runoff from a couple of neighboring farms. I saw water *gush* into the prairie, but I didn't see it come out. It got absorbed.

The soils in the prairie are loose and friable, loaded with worms and other biota, and the hardpan that causes much of today's flooding problem is now broken up. The lush perennial growth of the indigenous plants acts as a natural living filter, much like the newly touted artificial wetlands being used in the sewage disposal industry.

Our prairie has other uses too. It is our major insectary, a place to foster the growth of beneficial (as well as non-beneficial) insects. It teams with various types of wasps and other critters. They are all part of the living dynamic of pest management on our farm.

We graze our chickens in the prairie, or on the edge of it. And when we finally get a few herbivores, it will be part of the rotational grazing scheme, since the warm season prairie grasses produce their best pasture on a different schedule than most cultivated pasture grasses. (Maybe if the chickens had a few cows to follow, they wouldn't feel so intimidated about going deeper into the prairie.)

We pick flowers and seed from the prairie. The flowers are used in bouquets, and we allow interested parties to pick seed to start their own restoration. The seed is also a marketable product—a cottage industry of the farm.

We harvest ethnobotanical medicinals out of the prairie. Purple cone flower, mountain mint, bergomot, St. John's wort (non-native), and tall boneset all find their way into our home pharmacology.

The prairie is a haven and a habitat for song birds, game birds, waterfowl, mammals, reptiles, and amphibians, and in general much of the life displaced by conventional agriculture and urban sprawl. Its teeming life is what hunters and naturalists both desire.

Our prairie is a source of biomass. Remember switch grass and ethanol production? Switch grass, a prairie grass, was recommended because it is perennial and could be harvested easily. I wonder if the rest of the lush prairie community isn't applicable for the same use. And what about using it as a fiber source for paper?

The prairie is a source of building material. Our straw bale house will be built using prairie grass in its walls and chopped prairie grass in the cob-construction part. It makes great thatched roofs—no finer material available, at least around here. Too bad building codes and public sentiment make it almost impossible to use.

And finally, the prairie is a place to go and relax. There is no better place to meditate than among the myriad of life that only a grassland can support. It is the place I go to recharge and reconnect, and know there is a better way, and that it is important to keep trying.

This is why we chose to take some of our best soils out of production, and instead let them lay fallow. It may not be producing corn or soy beans, but it does serve a purpose.

[For more information, contact Greg David, Prairie Dock Farm, N8891, Co. Hwy. 'Y', Watertown, WI 53094. Phone: (920) 261-4292; email: prairiedf@globaldialog.com.]

Datebook

DATEBOOK is prepared with the cooperation of our readers. If you would like a meeting or event placed in the DATEBOOK, contact the NPS News-Notes editors. Notices should be in our hands at least two months in advance to ensure timely publication.

Meetings and Events for 1999

March

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- | | |
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| 4-5 | <i>Source Water Protection: Effective Tools and Techniques You Can Use</i> , Kansas City, MO. For more information, contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's web site at www.awwa.org/tande/eduframe.htm . |
| 11-12 | <i>Source Water Protection: Effective Tools and Techniques You Can Use</i> , Indianapolis, IN. For more information, contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's web site at www.awwa.org/tande/eduframe.htm . |
| 14-19 | <i>State of the Rivers: A Conference on Conservation of the Rivers of the American Southeast</i> , Chattanooga, TN. Contact Quinn McKew at the World Wildlife Fund, phone: (202) 861-8369; fax: (202) 887-5293; e-mail: Quinn.Mckew@wwfus.org . |
| 18-19 | <i>Source Water Protection: Effective Tools and Techniques You Can Use</i> , Farmington, CT. For more information, contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's web site at www.awwa.org/tande/eduframe.htm . |

March (continued)

- 18-19 *Conference on Stormwater and Urban Water Systems Modeling*, Toronto, Ontario, Canada. Contact Lyn James, Computational Hydraulics, Int., 36 Stuart Street, Guelph, Ontario, N1E 4S5. Phone: (519) 767-0197; fax: (519) 767-2770; e-mail: info@chi.on.ca; web site: www.chi.on.ca/conference99.html.
- 24-26 *EPA Region 7 Seventh Annual Nonpoint Source Conference and the Iowa State University Conference on Global Water Quality Issues*, Iowa State University, Ames, IA. The purpose is to provide a forum for presentations and discussion on the critical issues affecting water resources, research being conducted to address these issues, and the potential importance and impacts of the Clean Water Action Plan on midwestern states. Contact Richard Larson, AEP Coordinator, Iowa State University, Ames, IA at (515) 294-6429; e-mail: rwl Larson@iastate.edu; web site: extension.agron.iastate.edu/aged/water_quality/wqconf.html.
- 25-26 *Source Water Protection: Effective Tools and Techniques You Can Use*, Denver, CO. For more information, contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's web site at www.awwa.org/tande/eduframe.htm.
- 29-31 *1999 Georgia Water Resources Conference*, Athens, GA. The conference will focus its discussion on current water policies, research, studies, and water management in Georgia. Contact Kathryn J. Hatcher, Institute of Ecology, The University of Georgia, Athens, GA 30602; (706) 542-3709; fax: (706) 542-6040; e-mail: khatcher@ecology.uga.edu.

April

- 5-7 *Coastal Geo Tools '99: Exploring Spatial Technologies for the Coastal Resource Management Community*, Charleston, SC. Contact Conference Planners, P.O. Box 71487, Charleston, SC 29415; (843) 740-1334; e-mail: smeador@csc.noaa.gov; web site: www.csc.gov/GeoTools99.
- 8-9 *Source Water Protection: Effective Tools and Techniques You Can Use*, Milwaukee, WI. For more information, contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's web site at www.awwa.org/tande/eduframe.htm.
- 11-14 *Conference on Environmental Decision Making*, Knoxville, TN. Sponsored by the National Center for Environmental Decisionmaking Research (NCEDR), 314 UT Conference Center Building, Knoxville, TN 37996-4138; (423) 974-3939; fax (423) 974-4609.
- 14-17 *3rd Annual American Wetlands Month Conference*, San Francisco, CA. The conference will feature hands-on, interactive workshops where participants will learn how to solve their own wetland problems. Contact Terrene Institute, 4 Herbert Street, Alexandria, VA 22305. Phone: (703) 548-5473; fax: (703) 548-6299; e-mail: terrconf@erols.com.
- 15-16 *Source Water Protection: Effective Tools and Techniques You Can Use*, Seattle, WA. For more information, contact Mayme Larson at (303) 347-6204 or visit American Water Works Association's web site at www.awwa.org/tande/eduframe.htm.
- 19-21 *First Asia-Pacific Conference and Exhibition on Ground and Water Bioengineering for Erosion Control*, Manila, Phillipines. Contact North America-IECA, P.O. Box 774904, Steamboat Springs, CO 80477. Phone: (800) 455-4322; fax: (970) 879-8532; e-mail: ecinfo@ieca.org; web site: www.iwca.org.
- 19-21 *Program Review Meeting: Water and Watersheds*, Silver Spring, MD. Scientists funded by the joint EPA/NSF/USDA program in Water and Watersheds will present results from their recent research. For more information, visit www.epa.gov/ncerqa/ncqcalen.html.
- 22 *Earth Day; Ag-Earth Day* — contact Ag-Earth Partnership, National Council of Farmer Cooperatives, 50 F Street, NW, Suite 900, Washington, DC 20001.
- 24 *3rd Annual Ohio Limnology Conference and 13th Annual Ohio Lake Management Society Symposium*, Oxford, OH. For more information, a registration form, or to submit a paper, contact Bob Mason, Hamilton County Park District, 10245 Winton Road, Cincinnati, OH 45231, Attn: 3rd Annual Limnology Conference; phone: (513) 728-3551, ext 226; e-mail: bmason@tso.cin.ix.net; web site: www.olms.org.

May: American Wetlands Month

- 2-5 *National Town Meeting For A Sustainable America*, Detroit, MI. Sponsored by the President's Council on Sustainable Development. For more information, explore the NTM web site at www.sustainableamerica.org/about/default.cfm or call (888) 333-6878.
- 3-4 *EPA/WEF Analysis of Pollutants Conference*, Norfolk, VA. For more information, contact Cidy Simbanin at (202) 260-7117; fax: (202) 260-7185; e-mail: simbanin.cynthia@epa.gov.
- 6-8 *3rd Annual American Wetlands Month Conference*, Boston, MA. The conference will feature hands-on, interactive workshops where participants will learn how to solve their own wetland problems. Contact Terrene

May (continued)

- Institute, 4 Herbert Street, Alexandria, VA 22305. Phone: (703) 548-5473; fax: (703) 548-6299; e-mail: terrconf@erols.com.
- 10-14 *WEFTEC Latin America '99*, Rio de Janeiro. Contact the Water Environment Federation at (800) 666-0206; fax: (703) 684-2492; e-mail: confinfo@wef.org.
- 16-19 *6th National Watershed Conference*, Austin, TX. Contact John Peterson, Executive Director, National Watershed Coalition, 9304 Lundy Court, Burke, VA 22015-3431. Phone: (703) 455-6886; fax: (703) 455-6888; e-mail: jwpeterson@erols.com.
- 17-20 *National EPA State, Tribal, and Local Wetlands Program Symposium*, Boulder, CO. Contact the Conservation Tech. Info. Center, 1220 Potter Drive, Room 170, W. Lafayette, TN 47906. Phone: (765) 494-9555; fax: 765-494-5969; e-mail: ctic@ctic.purdue.edu; web site: www.epa.gov/OWOW/wetlands.
- 23-28 *10th International Soil Conservation Organization Conference, West Lafayette, IN. Sustaining the Global Farm: Local Action for Land Stewardship*. Contact ISCO99, Purdue University, 1196 Soil Building, West Lafayette, Indiana 47907-1196. Phone: (765) 494-8683; fax: (765) 494-5948; email: isco99@ecn.purdue.edu; web: 81SOecn.purdue.edu/~isco99.

June

- 6-10 *ASCE's Water Resources Planning and Management Division Conference*. The Task Committee on Evaluation of Best Management Practices will present a special set of papers on BMP's. Contact england@mindspring.com.
- 9-12 *3rd National Workshop on Constructed Wetland/BMPs for Nutrient Reduction and Coastal Water Protection*, New Orleans, LA. Contact Frank Humenik, North Carolina State University, Box 7927, Raleigh, NC 27695-7927; phone: (919) 5151-6767; fax: (919) 513-1023; e-mail: frank_humenik@ncsu.edu.
- 13-15 *2nd National Mitigation Banking Conference*, Atlanta, GA. Contact Terrene Institute, 4 Herbert Street, Alexandria, VA 22305. Phone: (703) 548-5473; fax: (703) 548-6299; e-mail: terrconf@erols.com.

July

- 24-30 *Coastal Zone '99*, San Diego, CA. Contact: Urban Harbors Institute, University of Massachusetts, Boston 100 Morrissey Blvd., Boston, MA 02125-3393.
- 11-14 *The Sixth Symposium on Biogeochemistry of Wetlands*, Ft. Lauderdale, FL. Contact the University of Florida, IFAS Office of Conferences by phone (352) 392-5930 or by fax (352) 392-9734, or by e-mail: mrp@gnv.ifas.ufl.edu or visit the University of Florida's web site at gnv.ifas.ufl.edu/~conferweb/#upcoming.

August/September

- 8-11 *Water Resources into the New Millenium: Past Accomplishments, New Challenges*, Seattle, WA. The 1999 International Water Resources Engineering Conference. Call (800) 548-2723; web site: www.asce.org/conferences/we99/index.html; or e-mail: conf@asce.org.
- 8-11 *Walk on the Wild Side, Soil and Water Conservation Society Annual Conference*, Biloxi, Mississippi. Contact Pat Mulligan (515) 289-2331, ext. 17; email: patm@swcs.org.
- 9-12 *1999 Stockholm Water Symposium: Urban Stability Through Integrated Water-Related Management*, Stockholm, Sweden. Contact the Stockholm International Water Institute at +46 -8-736-20-08; e-mail: sympos@siwi.org; web site: www.siw.org.
- 14-17 *6th Biennial Stormwater Research and Watershed Management Conference*, Tampa, FL. Contact Diane Caban, Mail Code: MAN, SWFWMD, 2379 Broad Street, Brooksville, FL 34609-6899. Phone: (352) 796-7211, ext. 4297.

Calls for papers — Deadlines

March 1, 1999

Tools for Urban Water Resource Management and Protection, February 7-10, 2000. Chicago, IL. A wide array of effective water quality management and protection tools have been developed—but their implementation is being hampered by a lack of technology transfer opportunities. To be considered for the conference program, authors should submit an abstract of 300-400 words that succinctly describes their project and approach. All abstracts must be received by no later than March 1, 1999. Contact Bob Kirschner, Natural Resources Department, Northeastern Illinois Planning Commission, 222 S. Riverside Plaza, Suite 1800, Chicago, IL 60606. Phone: (312) 454-0401, ext. 303; fax: (312) 454-0411; e-mail: bobkirs@nipc.org.

April 5, 1999

6th Biennial Stormwater Research and Watershed Management Conference, Tampa, FL on September 14-17, 1999. Abstracts due April 5; papers due July 5. Contact Diane Caban, Mail Code: MAN, SWFWMD, 2379 Broad Street, Brooksville, FL 34609-6899; phone: (352) 796-7211, ext. 4297.

Nonpoint Source News-Notes is an occasional bulletin dealing with the condition of the water-related environment, the control of non-point 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 27.) 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 (703) 548-5473 or FAX (202) 260-1977.

For additions or changes to the mailing list, please use the COUPON on page 27 and mail or fax it in. We are not equipped to accept mailing list additions or changes over the telephone.

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NONPOINT SOURCE

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