



# Nonpoint Source

# News-Notes

May 2005, #75

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



## SPECIAL FOCUS ISSUE: Economic Benefits of Nonpoint Source Pollution Control

### Notes on the National Scene

#### Saving Money Through Source Water Protection

Preventing contamination of raw drinking water supplies generally is more efficient than trying to identify and remove that contamination from the water stream at the treatment plant. By dedicating funds to restore and protect source water areas, communities are saving tremendous amounts of money over the long term. The following discussion, excerpted from “Protecting the Source: Conserving Forests to Protect Water,” an article in the May 2004 issue of the American Water Works Association’s newsletter, addresses the wastewater treatment economic benefits gained by protecting source water.

#### Clean Source Water is Key

Advancements in science and technology have enabled water utilities to effectively treat most known contaminants from drinking water sources and to provide American citizens with some of the safest drinking water in the world. However, these advancements have contributed to a movement away from protecting and managing our source areas and to the unfortunate notion that the quality of our raw water supplies is less important.



Oh noooo! Look who’s helping Governor Blanco save Louisiana’s wetlands. See article on page 12.

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Treatment alone, although critical to preventing disease, should not be the sole protection of our drinking water. Multiple barriers to disease agents need to be maintained if we are to provide the greatest protection to public health. A multiple-barrier approach to drinking water protection involves several consecutive and interrelated steps, including selection of high-quality source water(s), source water management and protection, appropriate treatment, distribution system management, and water quality monitoring.

More than a century ago, many of America's fastest growing cities, such as Boston and New York, bought land in their source areas to provide lasting protection of water resources critical for sustaining their populations in the future. To this day, these cities, some of the largest in the country, have relatively clean source waters that require minimal treatment.

*Protecting the Source Saves Money*

More and more often, potable water suppliers are realizing that allowing raw water quality to degrade, in addition to threatening public health, increases treatment and capital costs. Although little research has been done on this issue, a study of 27 water suppliers conducted in 2002 by the Trust for Public Land and American Water Works Association's Source Water Protection Committee found that water treatment costs for utilities using primarily surface water supplies varied depending on the amount of forest cover in the watershed. Water utilities were solicited for this survey based on the goal of providing a diverse range of watershed types.

**What is Source Water?**

Source water is untreated water from streams, rivers, lakes, or underground aquifers which is used to supply private wells and public drinking water. Most public and some private well drinking water is treated before it enters homes. While some treatment is usually necessary, the costs of treatment and risks to public health can be reduced by ensuring that source water is protected from contamination.

The survey results indicated that operating treatment costs decreased as forest cover in a source area increased. For every 10 percent increase in forest cover in the source area (up to about 60 percent forest cover), treatment and chemical costs decreased approximately 20 percent. Approximately 50 to 55 percent of the variation in operating treatment costs can be explained by the percent of forest cover in the source area. Not enough data were obtained on suppliers that had more than 65 percent forest cover in their watersheds to draw conclusions; however, the researchers believe that treatment costs level off when forest cover is between 70 and 100 percent. The remaining 45 to 50 percent variation in treatment costs that cannot be explained by the

percent forest cover in the watershed is likely due to varying treatment practices, economies of scale, the location and intensity of development and/or row crops in the watershed, and the prevalence of agricultural, urban, and forestry best management practices.

Table 1 shows the change in treatment costs predicted by this analysis, and the average costs of treatment if a supplier treated 22 million gallons per day (mgd).

**Table 1. Water treatment and chemical costs based on percent of watershed that is forested.**

| % of Watershed Forested | Treatment and Chemical Costs per million gallons | % Change in Costs | Average Treatment Costs (at 22 mgd) |           |
|-------------------------|--|-------------------|-------------------------------------|-----------|
|                         |  |                   | Per Day                             | Per Year  |
| 10%                     | \$115  | 19%               | \$2,530                             | \$923,450 |
| 20%                     | \$93   | 20%               | \$2,046                             | \$746,790 |
| 30%                     | \$73   | 21%               | \$1,606                             | \$586,190 |
| 40%                     | \$58   | 21%               | \$1,276                             | \$465,740 |
| 50%                     | \$46   | 21%               | \$1,012                             | \$369,380 |
| 60%                     | \$37   | 19%               | \$814                               | \$297,110 |

### *Forest Conservation as a Barrier*

Changes in land use can affect source water quality and, thus, treatment costs. Efforts to protect standing forests and natural lands from development or intensive agriculture will help communities avoid future increases in treatment expenditures. Improving land use practices and protecting lands that serve as natural filters for contaminants, such as forests, riparian areas, and wetlands, is critical to reducing pollutants that reach our raw water sources.

A growing understanding of the role that forests and natural lands play in filtering pollutants and maintaining water quantity has led many municipalities and water suppliers, particularly those in growing communities, to consider land protection as part of a multiple-barrier approach to providing safe drinking water. These communities have found that land conservation:

- offers permanent protection of critical watershed or recharge land;
- is perceived as equitable when landowners are compensated for their property's value;
- is broadly supported by voters;

#### **Forests Yield Clean Water**

Protecting forests is a cost-effective way to provide clean drinking water. Forests reduce flooding and erosion, filter impurities from water, and allow water to infiltrate and recharge aquifers. *Running Pure*, a report by the World Wildlife Fund and the World Bank ([www.panda.org/downloads/freshwater/runningpurereport.pdf](http://www.panda.org/downloads/freshwater/runningpurereport.pdf)), explores the important role forests play in drinking water protection.

#### **Clean Source Water Saves Money**

The Trust for Public Land and the American Water Works Association collaborated on a report titled *Protecting the Source: Land Conservation and the Future of America's Drinking Water*, which features a number of case studies showing how communities across the nation have protected their drinking water supplies. The report makes the case for protecting source water, and delves into the costs associated with many communities' need for increased treatment. The report highlights a number of cases where insufficient source water protection has led to the need for extensive capital outlay for treatment facilities, including:

- *Wilmington, North Carolina*. In part as a result of an increase in industrial and agricultural runoff in their watershed in the late 1990s, the city spent \$36 million to add ozonation and to expand its treatment facility.
- *Danville, Illinois*. In 2000 the city invested \$5 million in a nitrate removal facility to treat spikes in nitrogen resulting from agricultural runoff.
- *Decatur, Illinois*. In 2001 the city invested \$8.5 million in a nitrate removal facility to treat pollution associated with agricultural runoff.

The report also highlights examples of communities that, through source water protection efforts, have successfully alleviated the need for treatment facility construction, including:

- *Auburn, Maine*. The city saved \$30 million in capital costs, and an additional \$750,000 in annual operating costs, by spending \$570,000 to acquire land in their watershed. By protecting 434 acres of land around Lake Auburn, the water systems are able to maintain water quality standards and avoid building a new filtration plant.
- *City of New York, New York*. Instead of spending \$6 to \$8 billion on a new Catskill/Delaware filtration plant and \$300 million in annual operating expenses, the city chose to adopt an aggressive watershed management plan with land acquisition as its centerpiece. In January 1997 the city entered into a Watershed Memorandum of Agreement with 76 partners, including the U.S. EPA, the State of New York, virtually all of the counties, towns, and villages in its watersheds, and a number of environmental and public interest organizations. This agreement established a far-reaching program to protect all three of the city's watersheds—Catskill, Delaware, and Croton—including adoption of new watershed regulations, environmental and economic partnerships with watershed communities, and a watershed land acquisition program. Altogether, the city projects spending approximately \$1.2 billion over the first 10 years on a variety of watershed improvements.

To view the entire report, download *Protecting the Source* from [www.tpl.org](http://www.tpl.org) (Click on "Publications" in the left hand column). Hard copies are available for \$15.

- provides multiple benefits to communities, such as flood control, recreation, and the protection of historic and environmental resources; and
- offers land use control options for communities that do not have regulatory authority in their source area.

Local governments and water suppliers around the country are teaming up with land trusts, community groups, and other stakeholders to protect forests, wetlands, and other natural lands as part of a comprehensive, economical approach to protecting their drinking water sources.

[This article excerpted from *Opflow*, Vol. 30, No. 5 (May 2004), by permission. Copyright © 2004, American Water Works Association. For more information, contact AWWA at 6666 West Quincy Avenue, Denver, CO 80235-3098; Phone: 303-794-7711; Web: [www.awwa.org](http://www.awwa.org).]

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## Online Course Explains Benefits of Source Water Protection

The U.S. EPA's Drinking Water Academy (DWA) develops and provides training to federal, state, and tribal drinking water staff to help ensure that they will be adequately prepared to implement the provisions of the Safe Drinking Water Act (SDWA). The *Introduction to EPA's Drinking Water Source Protection Programs*, excerpted below, is one of the DWA's four introductory courses. The course is available online at [www.epa.gov/safewater/dwa/electronic/presentations/swp/swp.pdf](http://www.epa.gov/safewater/dwa/electronic/presentations/swp/swp.pdf) as a 119-page annotated slide presentation. The presentation conveys the concept of source water protection and program components, explains the economic and public health benefits of source water protection, outlines types of protection measures, describes interrelationships with Clean Water Act programs, and presents funding mechanisms for source water protection programs. The following six excerpts from the presentation provide valuable information about the economic and other benefits of source water protection.



(1) **Protect Source Water Now to Save Money Later.** The benefits to communities of protecting their drinking water supplies might best be understood by describing the costs of failing to protect them. These costs include those that are relatively easy to capture in monetary or economic terms and those that are not. Some easily quantifiable costs of drinking water supply contamination include treatment and remediation; finding and developing new supplies and providing emergency replacement water; paying for consulting services and staff time; litigating against responsible parties; and loss of property value or tax revenue.

Some costs that are not easily quantified include health-related costs from exposure to contaminated water, lost production of individuals and businesses, interruption of fire protection, loss of economic development opportunities, and lack of community acceptance of the claim that their drinking water is sufficiently treated to remove the contamination.

(2) **Economic Costs of Not Protecting Water Supplies.** Dealing with contamination is expensive. Consider the following communities' experiences. In Perryton, Texas, carbon tetrachloride was detected in the ground water supply. Remediation of the problem cost this small community an estimated \$250,000. Pesticides and solvents in the groundwater of Mililani, Hawaii, required the city to build and operate a new treatment plant. The plant cost \$2.5 million, and annual operation costs are \$154,000. The towns of Coeur d'Alene, Idaho, and Atlanta, Michigan, have experienced contamination of their ground water supplies. Each had to replace its water supply, at costs of approximately \$500,000. Preventing drinking water contamination at the source can save communities similar response costs.

(3) **Economic Benefits of Source Water Protection.** Protecting the quality of source water can save communities money in a number of ways, including:

- *Fewer Regulatory Costs.* Communities with effective drinking water contamination prevention programs may enjoy substantial savings in the costs of complying with SDWA or similar state regulations. They also may be eligible for waivers from some monitoring

requirements, thereby reducing monitoring costs. Such waivers have already saved Massachusetts water systems approximately \$22 million over the three-year compliance cycle, while Texas water systems saved \$49 million over two and one-half years.

- *Maintain Clean Water's High Value.* Water can be thought of as a commodity that water systems sell and farmers use as a raw material. Once it becomes contaminated, it loses value because it cannot be sold to customers, or it must be treated prior to being sold or used. Uncontaminated water has value to the public water system, determined by the price of water its customers are willing to pay.
- *Maintain Land Value.* Preventing contamination of drinking water can also help to maintain real estate values in areas served by protected water supplies. A survey by the Freshwater Foundation found that five Minnesota cities collectively lost over \$8 million in tax revenues because of real estate devaluation due to ground water pollution.

(4) **Clean Water's Quality of Life Benefits.** In addition to the monetary benefits of preventing contamination of drinking water supplies, there are benefits that are difficult (or controversial) to assign a dollar value. While difficult to quantify monetarily, many of these are tied to quality of life and may rival or exceed more tangible benefits in importance. For example, protection of human health is the driving force behind the nation's water supply protection programs. Other quality of life benefits include safeguarding resources for future generations, building confidence in the water supply, and maintaining healthy ecosystems and opportunities for recreation.

(5) **Clean Water's Human Health Benefits.** Preventing contamination of drinking water supplies should result in reduced risk to human health from both acute and chronic ailments. Overall, the U.S. is doing a good job delivering safe drinking water to the public, but challenges remain and may increase as new variants of waterborne disease agents and chemicals are discovered in water supplies. Although most people experience only mild illnesses from waterborne microbes, pathogenic organisms such as *Cryptosporidium* and some strains of *E. coli* can be transmitted to people through drinking water and cause serious illness or even death. In addition to threats posed by microbial contaminants, other substances can contaminate water supplies and threaten human

health. Metals, volatile organic carbons, synthetic organic chemicals, and pesticides can cause serious health problems for persons exposed to them over long periods of time at levels exceeding health-based drinking water standards. Potential health effects of long-term exposure to these pollutants include cancer, birth defects, and organ, nervous system, and blood damage. The health-related costs of contamination can include lost wages, hospital and doctor bills, and in extreme cases, death.

(6) **Costs of Prevention Versus Reaction.** EPA studied the contamination and prevention costs borne by six small-and medium-sized communities that experienced contamination of their ground water supplies and subsequently established a national wellhead protection program framework. Costs of contamination included costs of remediation activities, replacing water supplies, and providing clean water. Prevention costs include basic program costs for delineating a protection area, identifying potential sources of contamination, developing an initial management plan, and planning for alternative water supplies and other responses in case of an emergency. The ratio of the benefits of avoiding contamination to the costs of

### EPA's Source Water Protection Mission

Preventing contamination of drinking water supplies is an important mission within EPA's Office of Ground Water and Drinking Water. This office supports a Source Water Protection Web site ([www.epa.gov/safewater/protect.html](http://www.epa.gov/safewater/protect.html)), which provides a collection of available source water protection tools for community planners, public water supply operators, members of local source water protection teams, and anyone interested in protecting their sources of drinking water. It primarily focuses on source water resources either produced by EPA, or which EPA has supported through grants. Resources include source water information and guidance publications, public outreach materials, information about training, financial assistance information, examples of local source water protection, and tribal source water program information. The site also provides links to other organizations involved in source water protection, including other federal agencies, states, drinking water organizations, environmental and public health organizations, trade associations, and international organizations.



the wellhead programs ranged from 5:1 to 200:1. (For more information, see *Benefits and Costs of Wellhead Protection: Case Studies of Community Wellhead Protection*. EPA 813-B-95-005, March 1996 – available for free from the National Service Center for Environmental Publications: [www.epa.gov/ncepihom](http://www.epa.gov/ncepihom)).

Comparing the costs of contamination to the costs of prevention reveals that prevention programs are generally well worth the cost and effort as an effective “insurance” against contamination and its associated costs. If you add the considerable quality of life benefits that are potentially provided by a source water protection program, the program may prove to be a bargain.

[To read the Drinking Water Academy source water training presentation in its entirety, see [www.epa.gov/safewater/dwalelectronic/presentations/swp/swp.pdf](http://www.epa.gov/safewater/dwalelectronic/presentations/swp/swp.pdf).]

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## National Wildlife Refuges Offer Economic Windfall for Neighbors

A 2002 study by the U.S. Fish and Wildlife Service (USFWS) showed that the USFWS' National Wildlife Refuges are major economic engines for neighboring communities, adding hundreds of millions of dollars in jobs and retail sales. The importance of these areas for wildlife protection, natural area preservation, and economic benefits is obvious. According to the study, the more than 35.5 million visits to the nation's 540 refuges fueled more than \$809 million in sales of recreation equipment, food, lodging, transportation, and other expenditures in 2002. That figure is more than double the \$401.1 million generated in 1995, the last time the study was conducted.

As refuges generated recreation spending, nearly 19,000 jobs were created and more than \$318 million was generated in employment income. The 2002 employment statistics were nearly double the 1995 figures, when 10,200 jobs were attributed to the existence of refuges and about \$163 million was generated. The total for sales and tourism related revenue plus employment income — \$1.12 billion, in total — is nearly four times the \$320 million that the National Wildlife Refuge System received in FY 2002 for operation and maintenance.

[For more information, see *Banking on Nature 2002: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation*, available at [http://refuges.fws.gov/policyMakers/pdfs/BankingOnNature2002\\_101403.pdf](http://refuges.fws.gov/policyMakers/pdfs/BankingOnNature2002_101403.pdf).]

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## American Wetlands Month Observed

During the month of May, the nation will celebrate American Wetlands Month, focusing on the economic benefits that wetlands provide. The Environmental Protection Agency joins with other federal, state, and local agencies to recognize the wonderful ways that wetlands enrich the environment and society. Events are scheduled all across the country to educate and involve Americans in better understanding the importance of one of Earth's most valuable and fragile ecosystems. Also known as marshes, swamps and bogs, wetlands are important for flood control, acting as buffers to absorb and reduce damage caused by flood waters. They are productive ecosystems that support sometimes rare plant and animal habitat. Wetlands also help to remove pollutants from water, cleaning streams and lakes, thereby reducing the cost of drinking water treatment. Wetlands are important to the multi-billion dollar commercial fishing industry and provide a boost to recreation industry activities such as fishing, birding, canoeing and hunting. While more than half of the nation's original wetlands have been lost or converted to other uses in the lower 48 states, EPA's goal is to help increase the quantity and quality of wetlands nationwide. To learn more about activities for American Wetlands Month, go to [www.epa.gov/owow/wetlands](http://www.epa.gov/owow/wetlands) and [www.iwla.org/sos/awm/events/](http://www.iwla.org/sos/awm/events/).



The slogan for this year's Wetlands Month celebration is "It Pays to Save Wetlands."

# News from States, Tribes, and Localities

## Low-Impact Development Pays Off

What exactly is low-impact development (LID), and how does it compare with conventional stormwater management? In traditional stormwater management, water from a development site is moved away as quickly as possible to a centralized facility, such as a stormwater pond or a local stream. LID attempts to mimic the drainage patterns that were present before development by encouraging runoff infiltration, storage, filtering, evaporation, and detention.

Estimates from pilot projects and case studies suggest that LID projects can be completed at a cost reduction of 25 to 30 percent over conventionally developed projects. The need for costly stormwater ponds, drainage pipes, curbs and gutters, and wide streets is eliminated or dramatically reduced, which usually more than offsets the cost of relatively less expensive LID features such as rain gardens, cisterns, and permeable surfaces. The following examples show how rapidly LID is gaining acceptance across the country.

**Prince George's County, Maryland.** In the early 1990s, Somerset subdivision became one of the first large residential communities to include rain gardens as part of an LID drainage design. Rain gardens were a local innovation when Larry Coffman, associate director of the county's Department of Environmental Resources, considered options for the Somerset project. Coffman helped design a plan to create open drainage swales and replace the typical ponds, curbs, gutters, and sidewalks with special gardens on each lot to capture the runoff. Rain gardens are inexpensive to build, need very little maintenance, and restore water to the soil. Somerset is an 80-acre subdivision containing about 200 homes valued at approximately \$160,000 in 1995. Most 10,000-square-foot lots have a 300- to 400- square-foot rain garden, although some of the subdivision was completed prior to inclusion of LID.

Each rain garden cost about \$150 for excavation and \$350 for plants. About \$100,000 was needed to install rain gardens at Somerset, in comparison to nearly \$400,000 needed to install conventional detention ponds, which did not include the expense of curbs, gutters, and sidewalks. Elimination of the need for a stormwater pond allowed the development of six extra lots and resulted in a cost savings of more than \$4,000 per lot.

In November 2000, Prince George's County initiated a field monitoring program to compare the stormwater hydrologic and water quality responses between two watersheds in Somerset subdivision. Development in the first watershed was completed in the early 1990s with conventional stormwater conveyance techniques (curb, gutters, and pipes). Development in the second watershed, located directly next to the first, was completed in 2000 and includes the rain garden and grassed swale LID techniques (see photo). Preliminary monitoring results indicate that the LID

site experienced a 20 percent lower average annual runoff volume per unit area than did the conventionally designed watershed. The LID watershed generated fewer runoff-producing events overall (see table 2).



Paired watershed study in Maryland's Somerset subdivision offered opportunity for comparison between conventional and LID stormwater design techniques.

**Table 2. Somerset Paired Watershed Study: 2-Year Hydrologic Summary**

| Measurement □  | Watershed □    |        |
|--|----------------|--------|
|  | Conventional □ | LID □  |
| Number of events with measurable runoff >100 cubic feet* | 104            | 83     |
| Total runoff volume (cubic feet/acre)*                   | 41,403         | 33,391 |
| Percent of rainfall converted to total runoff*           | 19.0%          | 15.3%  |

\* Difference is significant at the 95% confidence interval

Preliminary monitoring also showed that metal levels in the runoff in the LID watershed were significantly lower than in the conventional watershed (36%, 21%, and 37% lower for copper, lead, and zinc, respectively). However, nitrogen levels were the same in both watersheds, while phosphorus levels were actually higher in the LID watershed. Project leaders suspect the LID watershed has higher-than-expected nutrient levels because it is still relatively new and is experiencing unstable soils and over-fertilization by homeowners. Project leaders expect the water quality in the LID watershed to improve significantly over time.

Prince George's County is pleased with the performance of the LID techniques at Somerset. Residents are also pleased—they have enthusiastically accepted their rain gardens and maintain them like they do other parts of their yard. Originally viewed as “free landscaping” by many residents, the naturalized rain gardens have become a key part of subdivision's identity. (Sources: (1) U.S. HUD, 2003. *The Practice of Low Impact Development (LID)*. U.S. Department of Housing and Urban Development, Office of Policy Development and Research. Available online at [www.lowimpactdevelopment.org/lid%20articles/practLowImpctDevel\\_jul03.pdf](http://www.lowimpactdevelopment.org/lid%20articles/practLowImpctDevel_jul03.pdf). (2) Hydrological Responses from Low Impact Development comparing with Conventional Development, by Mow-Soung Cheng, Larry S. Coffman, Yanping Zhang, and Z. John Licsko.)

**Sherwood, Arkansas.** Developers of the Gap Creek Subdivision used LID concepts, allowing them to gain 17 additional lots. Each lot sold for \$3,000 more than comparable competitors' lots, and lowered the total cost per lot by \$4,800. The project also resulted in 23.5 acres of green space and parks, \$2.2 million in additional profit, and national recognition. The new design worked with the land's features. For instance, drainage areas were preserved and buffered by green space called greenbelts. The network of greenbelts were connected to neighborhood hiking trails. Streets meandered with terrain to minimize excavation needs. By maximizing the number of lots that backed up to greenbelts, the developers provided homeowners with a sense of privacy which led to higher lot prices.

The original plan's street was changed to include green space buffers and traffic calming circles thus allowing the developer to reduce street widths from 36 to 27 feet. In addition, trees were allowed to stay close to the curb line. The site uses native vegetation such as buffalo grass, and cleared trees were transformed into mulch. The original plan preserved 1.5 acres of green space while the revised plan preserved 23.5 acres. Some of the development cost savings went to fund a neighborhood park with picnic facilities, a pavilion, and ball fields. (Source: Tyne, Ron, 2000. *Bridging the Gap: Developers Can See Green*. National Association of Home Builders Land Development Magazine, Spring - Summer 2000, pp 27-31.)

**Aberdeen, North Carolina.** Design engineers for the Poplar Street Apartments used an alternative LID stormwater control design for a new 270-unit apartment complex and saved the developer approximately 72 percent, or \$175,000, of the conventional stormwater construction costs. At the site, almost all of the conventional underground storm drains associated with curb and gutter projects were eliminated. Strategically located bioretention areas, compact weir outfalls (see photo), depressions, grass channels, wetland swales, and specially designed stormwater basins were some of the LID techniques used. These design features allow for longer flow paths, reduce the amount of polluted runoff, and filter pollutants from stormwater runoff. (Source: *Storm Water Solutions For New Mandatory Federal Storm Water Regulations*, Fall 1999 newsletter of BLUE: Land, Water, and Infrastructure, available at [www.blwi.com/n\\_fall99.htm](http://www.blwi.com/n_fall99.htm))



In Aberdeen, NC, a compact weir releases water on all sides, distributing stormwater to bioretention cells.

**Largo, Maryland.** At the Inglewood Demonstration Project, engineers retrofitted an existing parking facility with a bioretention area. They selected a landscaped island measuring



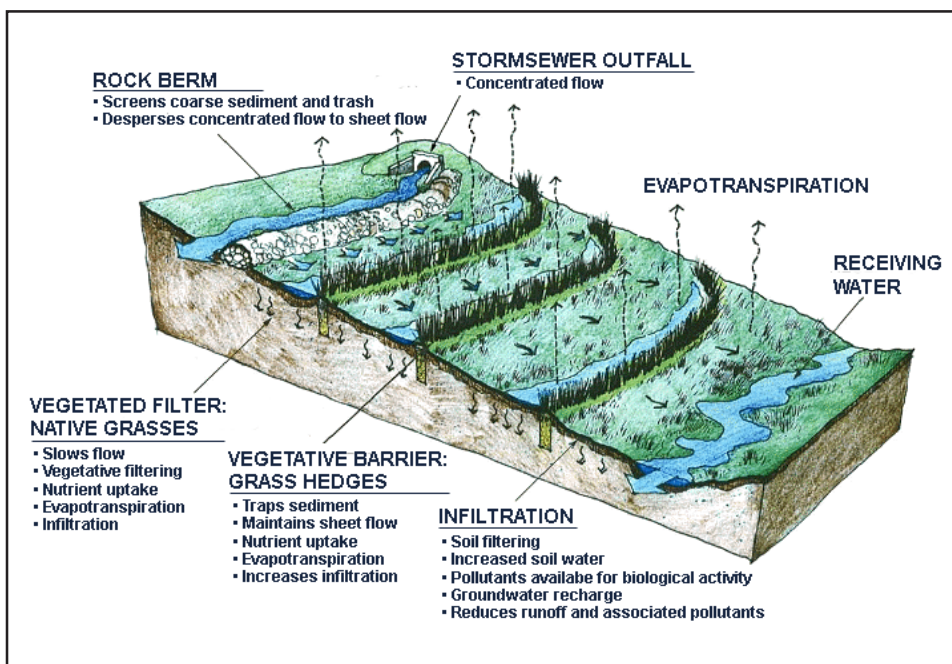
about 38 feet by 12 feet to be retrofitted to treat runoff from a half-acre of impervious surface. They cut a four-foot slot into the curb immediately before the storm drain inlet, excavated the landscaped island to a depth of four feet, and installed an underdrain that would allow the soil in the island to slowly drain, preventing oversaturation. Next, they covered the underdrain with eight inches of one- to two-inch gravel and backfilled with typical bioretention soil mix up to a depth of about 12 inches below the top of the curb. Finally, they planted the area and covered it with three inches of shredded hardwood mulch. Water collects in the island to a ponding depth of approximately six inches before a backwater is created at the curb opening.

Results showed that the project lowered runoff temperature by 12 degrees C, and significantly reduced metals and other pollutants present in the runoff. The retrofit cost \$4,500 to construct, while usual methods of treating that runoff would have cost \$15,000-\$20,000 and involved fewer environmental benefits and higher maintenance costs. (Source: USEPA, 2000. Bioretention Applications. Document 841-B-00-005A. Available online at [epa.gov/nps/bioretention.pdf](http://epa.gov/nps/bioretention.pdf))

**Pierce County, Washington.** Pierce County directed a study looking at the use of potential LID technologies in Kensington Estates, a conventional, 103-lot single-family development planned on 24 acres. The LID design of the roadways and utilities called for a reduced roadway width, porous paving, and cul-de-sac clusters. The cul-de-sac design included vegetated depressions in the center of each that would capture and retain six inches to one foot of runoff. These LID features generated costs that would be slightly higher than the costs for conventional materials and design. However, the study showed that over the entire 24-acre development site, the LID approach would generate construction cost savings of more than 20 percent over a conventional approach, preserve 62 percent of the site in open space, maintain the project density of 103 lots, reduce the need for, and size of, storm pond structures, eliminate catch basins and piped storm conveyances, and achieve “zero” effective impervious surfaces. (Source: CH2MHill, 2001. Pierce County Low Impact Development Study. Available online at [www.pierce.wsu.edu/Water\\_Quality/LID/CH\\_Final\\_LI\\_Report.pdf](http://www.pierce.wsu.edu/Water_Quality/LID/CH_Final_LI_Report.pdf))

**Austin, Texas.** The City has had a plan for buffering streams for the protection of the Edwards Aquifer for many years, but in some cases, runoff from subdivisions was still collected by curb and gutter and discharged as a concentrated flow directly to the buffered streams. In Austin’s Circle C Ranch subdivision, engineers converted the concentrated storm sewer point discharge to a system

that encouraged sheet flow along the buffer (see picture). The redesign included placement of a rock berm along a drainage ditch located at the top of the grassed stream buffer. The runoff percolated through the berm and flowed across the entire width of the buffer before entering the stream. The engineers also planted a series of native grass hedges to help distribute flow along the buffer. This redesign created four biodetention areas at a total cost of \$65,000, much less than the \$250,000 sedimentation-filtration pond that would have otherwise been required. Per lot cost was approximately \$450 compared to \$1,700 for the sedimentation-filtration pond. Additional cost savings were realized through reductions in storm drain pipe sizes and trenching depth. (Source: Scaief and Murfee. 2004. Subdivision



At Austin, Texas’ Circle C Ranch Subdivision, engineers designed a drainage system that encourages stormwater sheet flow across a vegetated buffer.

## *River Stars Program Saves Money and the Environment*

The nonprofit Elizabeth River Project's River Stars Program exemplifies the notion that pollution prevention can yield profits for companies. The southeastern Virginia-based program encourages industry, government, and other facilities in the Elizabeth River watershed to pursue voluntary pollution prevention and wildlife habitat goals, and rewards them for their successes. Since its inception in 1997, the River Stars Program has documented a reduction of hazardous waste and other pollution by more than 144 million pounds and restoration or conservation of more than 220 acres of wildlife habitat. Thanks to a bit of innovative thinking, the River Stars Program facilities found economically feasible—and sometimes economically beneficial—ways to reduce pollution.

The 200-square mile Elizabeth River watershed includes the Virginia cities of Norfolk, Portsmouth, Chesapeake, and part of Virginia Beach. The Elizabeth River drains into the Chesapeake Bay, and has been identified by the Chesapeake Bay Program as one of the three most toxic regions of concern in the bay watershed, due to high levels of pollution in its waters and sediments.

### *Program Promotes Ongoing Achievement*

Through the River Stars Program, the Elizabeth River Project promotes a non-regulatory, partnership-based approach with private industry and others to reduce and prevent pollution. Elizabeth River Project staff provide River Stars facilities with project recommendations, project funding acquisition, project design and other technical assistance, volunteer event planning, documentation of results, and public recognition of successes. River Stars projects typically include reduction, elimination, or recycling of waste materials in an industrial process, establishment or restoration of a wildlife habitat area, and onsite stormwater management improvements such as efforts to capture and reuse stormwater. Most companies have enjoyed corresponding cost savings through reduced need for materials, labor, and waste treatment or disposal.

About 50 facilities currently participate in this program. (The Elizabeth River Project also has a separate River Stars schools program.) The program provides for three levels of achievement, each of which requires different degrees of success with pollution prevention or wildlife habitat projects. This three-tiered, interdisciplinary approach allows facilities to start small and build on their successes. Many River Star facilities maintain their designated level of environmental excellence from year to year by adding to previously initiated projects and enlarging wildlife habitat areas. The River Stars Program encourages participating facilities to continually implement new projects so they can be recognized each year and/or be awarded a higher level of achievement.

### *Reducing Pollution and Costs*

River Stars' impact on nonpoint source pollution is growing. Historically, many of the projects were associated with pollution reduction in industrial processes and the impact on water quality was an indirect one. This impact was largely associated with reductions in landfill waste, air emissions, and contaminants in treated wastewater. Now, more River Stars facilities are branching out into stormwater management and wildlife habitat projects—projects that can directly reduce nonpoint source pollution. Many of these projects have also provided unexpected economic benefits.

NOVA Chemicals, Inc., a manufacturer of polystyrene resin, created an 11-acre “no-mow” area of 3,000 native trees and shrubs, designed to provide food and shelter for migrating songbirds. The native plants also reduce soil erosion and improve the quality of stormwater runoff reaching the river. After implementing the project in 1999 at a cost of less than \$8,000, the company found it was saving \$16,000 annually by no longer mowing the land. “We tried to do the right thing for

the environment and were rewarded with an unexpected cost savings,” explains Van White, NOVA Chemical’s Environmental Manager. “We’ve also received a number of awards and great publicity from several newspaper articles.” NOVA isn’t the only River Stars facility reaping rewards from its wildlife habitat project. ExxonMobile invested \$3,000 in a similar wildlife area, and now saves approximately \$4,000 annually in mowing costs. Exxon’s project earned them the ExxonMobile Corporation’s “Terminal of the Year” award in 2002.



**NOVA Chemical’s “no-mow” area before and after project completion.**

A growing number of River Stars facilities capture and reuse their stormwater, reducing the need to purchase water and reducing the amount of water released to the river. Southern States Cooperative, a fertilizer manufacturer, saves money with its innovative rainwater collection project. Using an existing retention pond and adding a new \$600 portable pump, the company began pumping the site’s stormwater to an old rail tanker car that they converted into a cistern. The tanker car stores the water for use in the manufacturing process. The company uses about 150,000 gallons of rainwater per year this way—water that would otherwise be purchased—saving the company more than \$500 each year. This captured stormwater already contains low levels of nitrogen and phosphorus (largely from airborne sources) that are incorporated into the fertilizer, saving the company roughly an additional \$1,500 annually. Because the runoff is collected and reused, the company no longer has to pay to monitor stormwater which costs more than \$500 each year for sample analysis plus the variable costs of the time staff spent collecting samples whenever it rained. “For an extremely minimal cost we are seeing significant savings,” explains Mark Cowley, Southern State’s River Stars representative. “And every bit of savings helps.” More information about these and other River Stars projects is available on the Elizabeth River Project Web site at [www.elizabethriver.org/RiverStars/RiverStars.htm](http://www.elizabethriver.org/RiverStars/RiverStars.htm).

The success of the River Stars Program is great for the companies and the Elizabeth River watershed, notes Pam Boatwright, Elizabeth River Project’s River Stars Program manager: “The companies are pleased that their River Star projects are not only protecting the environment and the bottom line, but also generating publicity and recognition within the community and beyond.” The River Stars Program is a great example of

### **One Piece of a Much Larger Puzzle**

The River Stars Program is one of the Elizabeth River Project’s many activities. In its 2002 Watershed Action Plan, the Elizabeth River Project outlined 14 actions to help restore the river over the long term. These include the “Goo Must Go” campaign, which promotes river sediment clean up, as well as point and nonpoint source pollution prevention, public education, water quality monitoring, habitat restoration, and other environmental improvements and protections. For more information, see the Action Plan and other Elizabeth River Project publications at [www.elizabethriver.org/Publications/](http://www.elizabethriver.org/Publications/).

how investing in non-regulatory, partnership-based approaches can often lessen costs while reducing pollution from point and nonpoint sources.

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## Looming Economic Losses Energize Louisiana's Coastal Restoration

Louisiana's uncomfortably close call with Hurricane Ivan last year renewed the sense of urgency in ongoing efforts to protect Louisiana's continually eroding coastline and vulnerable low-elevation inland areas. According to the Louisiana Department of Natural Resources, coastal Louisiana wetlands are being lost at the rate of 24 square miles every year, a total of 1,900 square miles since the 1930s. The loss of coastal wetlands increases the likelihood that a hurricane or other strong storm will cause devastating, and expensive, damage to resources both onshore and off.

Hoping to increase national awareness of the importance of Louisiana wetlands and the role they play in protecting life and property, Louisiana Governor Kathleen Blanco spoke out in a Washington Post editorial in December 2004. She emphasized that the nationally significant energy, economic, and transportation infrastructure that is situated along the Louisiana coast could be damaged by future large storms—effectively crippling the nation. Like other governors before her, she is seeking innovative financial mechanisms to help mitigate the impact of natural disasters by restoring the state's disappearing coastal wetlands. Governor Blanco argues that by investing restoration dollars today, the nation could better protect itself from a future national disaster.



**Louisiana coastal wetlands provide wintering habitat for more than 5 million waterfowl and migratory birds.**

### Why are Louisiana's Coastal Wetlands Disappearing?

For the last several thousand years, Louisiana's coastal wetlands expanded as floodwaters from the Mississippi River deposited enormous volumes of sediment and nutrients on the continental shelf at the river's mouth. During the twentieth century this pattern was reversed, resulting in continuous coastal erosion. Why? In 1928, to protect floodplain property from periodic flooding, the federal government began building levees and dams to contain and constrict the Mississippi River. Levees prevented the slow-flowing, sediment-laden natural flooding events from replenishing the coastal wetlands. They also cut off natural secondary and tertiary distributaries that fed the wetlands with freshwater, replacing them with straightened channels that often sent salt water back into freshwater marshes and destroying them. Over time, the wetlands shrank. Other factors contributing to wetland declines include channels dug for oil and natural gas conveyance, and battering by periodic hurricanes. For photos and videos of historic wetland losses, see [www.lacoast.gov/education/loss](http://www.lacoast.gov/education/loss).

### Partnering for Restoration

To reverse the trend of wetland loss and better protect the Louisiana shoreline, the state of Louisiana has been working with the U.S. Army Corps of Engineers, the National Oceanic and Atmospheric Administration, and other partners to develop and implement a plan for coastal wetlands restoration. Known as the Coast 2050 Plan, the plan seeks to restore and/or mimic natural landforms and ecosystem functions along a wide swath of Louisiana coastal area.

The restoration will not be easy—or cheap. Cost estimates run as high as \$14 billion over 30 years. Len Bahr, Director of Applied Science at the Louisiana Governor's Office of Coastal Affairs, points out that the restoration plan is "one of the largest engineering projects ever attempted in the world." The plan attempts to reengineer the deltaic river system with marsh creation, barrier island restoration, river water re-introduction, sediment diversions, sediment and nutrient trapping, and vegetative planting. The plan has gained attention for its potential to decrease nutrient flux into the Gulf of Mexico, by trapping nutrients in the marshes, which might help alleviate the problem of the hypoxic "dead" zone, an area of low dissolved oxygen in the Gulf. For more details on Coast 2050, see <http://lacoast.gov/programs/2050>.

*Looming Economic Losses Energize Louisiana's Coastal Restoration (continued)*

*Funding Coast 2050*

Considering the national importance and high cost of the plan, Louisiana continues to negotiate for additional federal funding while also seeking other public and private funding sources. The state currently receives regular federal assistance for coastal restoration projects through the Breaux Act, also known as the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA). Each year the Louisiana restoration program receives approximately \$50 - \$60 million, to which it adds matching funds. This is far from enough to cover the implementation of the Coast 2050 Plan, but the Breaux Act may continue to be a federal funding vehicle. In December 2004, the President signed a bill that included an extension of the Breaux Act until 2019.

*An Ounce of Prevention is Worth a Pound of Cure*

At the heart of the Coast 2050 Plan is the economic argument that the potential cost to the nation and the state if the wetlands are not restored is \$100 billion in infrastructure alone. Investing \$14 billion seems more reasonable when viewed from this angle. A strong consideration in the "opportunity cost" accounting of wetlands restoration is the vulnerability of key oil ports in the Gulf of Mexico to threats from storm surges. If high water covers the vulnerable production platforms and critical highways to and from the area, oil and gas supplies that currently serve almost a quarter of the nation will be cut off. (For more information, see [www.la1coalition.org](http://www.la1coalition.org).) Both the energy industry and the nation's energy consumers have a lot at stake. For this reason, Louisiana is working to increase the local and national visibility of its wetland problems.

*Campaigning for America's Wetland*

In 2002, Louisiana launched "America's Wetland," a nationwide publicity campaign and education effort intended to raise the visibility and concern about the disappearing coastal wetlands to a national scale, commensurate with the effect it could have on America's economy and natural heritage. "America's Wetland" campaign participants include oil industries, business groups, local and national environmental organizations, and local, state, and federal agencies. The campaign's innovative publicity strategies include national television spots featuring 1970s Saturday Night Live claymation icon Mr. Bill, a Web site, print media ads, press releases, and press packets. (For more information, see [www.americaswetland.com](http://www.americaswetland.com).)

Campaign partners give time and resources for either public education or restoration efforts. The Shell Oil Company Foundation pledged \$3 million in seed money to start the campaign. The McIlhenny Company, producer of Louisiana's famous Tabasco Hot Sauce, is including informational cards on bottles of Tabasco distributed internationally. The Louisiana Bankers Association funded a \$40,000 initiative to insert literature into bank statements for public



All boxes of Tabasco sauce now feature information about the America's Wetland campaign.

**Why are Louisiana Wetlands so Important?**

- They support a commercial fishing industry that harvests more than 1.1 billion pounds of finfish and shellfish annually, accounting for approximately 27 percent of the total catch by weight in the lower 48 states.
- They provide habitat for more than five million wintering waterfowl.
- They ensure continued revenue from hunting, recreational fishing, and ecotourism. Recreational fishing revenues contribute more than \$235 million per year to Louisiana's economy.
- They provide storm protection for natural gas production worth \$7.4 billion per year.
- They provide storm protection for coastal refineries, which produce \$30 billion worth of petroleum products annually.
- They provide storm protection for a waterborne commerce industry that moves 400 million tons of products through coastal channels every year and handles more commodities than all west coast ports combined.

For more information, see <http://lacoast.gov/education/2050faq.htm>.

education. They also help sponsor campaign fundraisers. Ducks Unlimited is giving \$10 million for restoration efforts outlined in the Coast 2050 Plan. A number of other organizations partnered to build a wetland trail and now work with canoe and kayak outfitters to help promote ecotourism. Louisiana hopes that the campaign will help secure additional funding for the restoration effort by increasing the public and private sectors' understanding of the immediate need to stem the tide of coastal wetland loss.

[For more information, contact Sidney Coffee, Executive Assistant, Office of the Governor/Coastal Activities, 1051 N. Third St., Capitol Annex Bldg, Suite 138, Baton Rouge, LA 70802; Phone: 225-342-4844; E-mail: [sidneyc@dnr.state.la.us](mailto:sidneyc@dnr.state.la.us).]

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## Notes on Watershed Management

### Lake Clarity Yields Property Value Increases

Two Bemidji State University (Minnesota) professors found strong links between lake clarity and land value in their June 2003 report titled "Lakeshore Property Values and Water Quality." The researchers examined 1,205 sales of lake-adjacent properties in Minnesota's upper Mississippi River basin from 1996 to 2001 to develop a quantitative relationship between lake clarity measurements and prevailing prices for properties adjacent to those same lakes.

The report is important because it "defines a dollar value of water quality to the northern Minnesota economy," according to Jane Eckholm, Executive Director of the Mississippi Headwaters Board. Similarly, previous studies of lakefront properties in Maine (see box) found that landowners place a premium on living next to clearer lakes. Both the Maine and Minnesota studies used hedonic regression analysis, a technique used to determine the implicit price of something that cannot be priced directly—in this case, water quality.

The researchers surmised that the value of water quality would be captured in the value of the land and that this portion of a property's price could be determined by examining how property prices change with differing levels of water quality, while controlling for other property characteristics. Lake clarity measurement was used as a surrogate for overall water quality. Eckholm noted that "Through objective scientific method, this study attaches tremendous economic value to investing in a clean environment."

#### *The Price of One Meter*

Based on the data, both the Maine study and the Minnesota study developed demand equations for various sub-regions in their respective study areas that infer the marginal amounts that people are willing to pay for improved water clarity. These equations show that for every meter of improved water clarity, a property's value would rise by tens to hundreds of dollars for each foot of lake frontage. The Minnesota study found "evidence [that] shows that management of the quality

### Lake Clarity Makes a Difference in Maine

Researchers from the Maine Department of Environmental Protection (DEP) and the University of Maine recently published data showing that lake clarity can significantly affect the property values of lakeside homes. Ray Bouchard and Kevin Boyle investigated property values around 36 Maine lakes and found that properties on a lake with a clarity one meter greater than another similar lake have higher property values in the range of 2.6 percent (\$2,563) to 6.5 percent (\$9,271), depending on the market. Likewise, a one meter decrease in clarity causes property values to decrease anywhere in the range of 3.1 percent (\$3,084) to 8.5 percent (\$12,050). Like previous studies, researchers compared properties based on location variables such as distance to nearest substantial town, type of road surface (gravel versus paved), density of other properties and cottages, property's lakefront footage, and lake surface area. Researchers also considered the structural variables that impact property value, including age and floor area of the unit, type of water supply and wastewater system, and presence of improvements (additions). Of all variables considered, lake surface area seems to have a large effect on the range of property values as it may affect individual perceptions of acceptable water quality. The researchers published their results in the Fall 2003 (Volume 23(3)) issue of the North American Lake Management Society's *LakeLine* magazine, available for order at [www.nalms.org/lakeline/1123-03.htm](http://www.nalms.org/lakeline/1123-03.htm). For more information on economic impacts of Maine lakes from the 1980s to the present, see [www.state.me.us/dep/blwq/doclake/research.htm](http://www.state.me.us/dep/blwq/doclake/research.htm), the Maine DEP's Lake Assessment Program Web site called "More on Dollars and Sense: The Economic Impact of Lake Use and Water Quality."

of lakes is important to maintaining the natural and economic assets of north-central Minnesota.” The Bemidji, Minnesota team, economist Dr. Patrick Welle and geographer Dr. Charles Parson, concluded that “collectively, changes in lake water clarity will result in millions of dollars in property values—lost or gained—in this lake region.” They see education as the key to sustaining or improving lake quality. Other research has corroborated the Minnesota and Maine findings: in 2000, two economists from the University of Maryland found that water quality had a significant positive effect on residential property values along the Chesapeake Bay.

The 58-page report is available on the Web at [www.mhbriverwatch.dst.mn.us/publications/lakeshore\\_property.pdf](http://www.mhbriverwatch.dst.mn.us/publications/lakeshore_property.pdf). The authors Dr. Patrick Welle and Dr. Charles Parson may be reached via e-mail at [pwelle@bemidjistate.edu](mailto:pwelle@bemidjistate.edu) and [cparson@bemidjistate.edu](mailto:cparson@bemidjistate.edu), respectively.

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## Report Reviews Economic Benefits of Watershed Protection

The Center for Watershed Protection ([www.cwp.org](http://www.cwp.org)), under contract with the Virginia Department of Conservation and Recreation, developed a report in 2001 to document economic costs and benefits of implementing environmental regulations. Through a comprehensive literature search, the CWP identified sources that illustrate land value and other benefits associated with environmental protection programs, as well as possible negative economic consequences of ineffective or non-existent programs.

The report, titled *Economic Benefits of Protecting Virginia's Streams, Lakes, and Wetlands*, documents the economic benefits of specific environmental regulations, including those pertaining to floodplains, water quality, conservation area protection, buffers, erosion and sediment control, and zoning. The numerous examples and references in this report identify several types of economic benefits resulting from these regulations. These benefits include increased property values, income from fisheries, recreation, tourism, and the marine industry, as well as savings or avoidance of costs related to flood damage, stormwater treatment, construction, infrastructure and maintenance, drinking water treatment, home heating and cooling, medical treatment (arising from waterborne illnesses), and stream/lake restoration. CWP found that these economic benefits, combined with the other, immeasurable benefits of preserving forests, and protecting habitat, biodiversity, and natural resources, makes the decision to establish many types of environmental regulations a justifiable and responsible approach to protecting water resources and the environment in general.

Although the cost and benefit figures are slightly out of date, this 2001 report still provides an eye-opening look at the significant economic benefits that nonpoint source control and other environmental protection and land conservation programs can provide. For a copy of the report, see [www.dcr.state.va.us/sw/docs/swmecon.pdf](http://www.dcr.state.va.us/sw/docs/swmecon.pdf).

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## Riparian Buffers Yield Economic Returns

Homeowners are willing to pay more to live near buffered streams and open space, according to a study in Missouri's Dardenne Creek watershed. When St. Charles County passed a “Natural Watercourse Protection Ordinance,” local developers raised concerns that the need to plan for and comply with the new requirements would ultimately increase the price of new homes. The ordinance requires a 25- to 50-foot buffer around streams (depending on stream size) on all land developed for residential or other non-agricultural uses. Fortunately, the Missouri Department of Natural Resources had an opportunity to fund a study that helped to address those concerns and provide a broader insight into the economics behind environmental amenities.

### *What Will People Pay?*

Researchers from the University of Missouri and the Greenway Network teamed up to conduct the study. They used two methods to determine people's “Willingness To Pay” (WTP) to live near a buffer, farmland, or other open space. First, researchers estimated people's WTP using a contingent valuation method (CVM), which is a survey-based methodology for estimating the value of

natural resources not subject to market forces. CVM is sometimes regarded as unreliable because the method asks people questions rather than observes their behavior. Second, the researchers estimated the actual market value of open space in the real estate market of the study area using a hedonic pricing method (HPM). HPM is a statistical method used to estimate economic values for environmental services that directly affect market prices. For more information about CVM, see [www.ecosystemvaluation.org/contingent\\_valuation.htm](http://www.ecosystemvaluation.org/contingent_valuation.htm). For more information about HPM, see [www.ecosystemvaluation.org/hedonic\\_pricing.htm](http://www.ecosystemvaluation.org/hedonic_pricing.htm).

**Contingent Valuation Method.** The researchers developed a survey with the help of a group representing a wide range of local stakeholders. The survey asked a variety of questions, some designed to gather basic demographic information, and others designed to assess the respondent's awareness of water quality issues and the economic and environmental importance of riparian buffers. The survey also presented a map with a variety of hypothetical home location scenarios (near a buffer, in a neighborhood with an accessible buffer, etc.) and asked the respondent to identify if he or she would be willing to pay more to live in each place. The researchers mailed the survey at random to 1500 households in the Dardenne Creek watershed. Researchers received and analyzed 264 completed surveys using CVM.

Results showed that people had a WTP of approximately \$6,858 to live on properties immediately adjacent to the community-owned and open accessible riparian buffers. Moreover, people were willing to pay approximately \$1,625 to live on a property in the same subdivision but not immediately adjacent to the buffer. For properties adjacent to preserved farmland the researchers determined the WTP to be approximately \$5,450.

**Hedonic Pricing Method.** To verify the results of the WTP survey, the researchers looked at the actual prices people paid for local properties immediately adjacent or near to preserved farmland or community-owned and open accessible riparian buffers. Using county property tax maps and information, the researchers selected a subset of homes purchased since January 2000 with the sale price within the range of \$75,000 to \$200,000. Of the 5,756 properties that met these criteria, the team selected 1,955 properties at random to ensure an even distribution of properties across the study area. The research team then used ArcView GIS to identify pertinent attributes of each property, including presence of nearby open space and proximity to flood zones and streams. An HPM statistical analysis of the sales price and property attributes showed that all properties within a 500-foot wide buffer zone around Dardenne Creek and its tributaries sold for \$2,500 to \$3,800 more than properties farther away. Properties adjacent to open space sold for \$4,600 to \$6,400 more than properties without open space.

### Development Drives New Protection Efforts

Residential development is swallowing prime farmland all across the United States at an alarming pace. The Natural Resource Conservation Service of USDA estimates that, over the past 20 years, the U.S. has lost enough farmland to fill the entire State of Illinois. St. Charles County has been experiencing rapid development, which covers the land with roads, houses, sidewalks and parking lots. These impervious surfaces prevent rainwater from soaking into the ground, and as a result, runoff is increased, flooding occurs, water quality is degraded, and wildlife habitat is lost. When it passed its new buffer ordinance, St. Charles County became one of countless communities across the nation that are trying keep development impacts under control by mandating implementation of low impact development techniques and preservation of riparian buffer zones. Buffers provide aesthetically pleasing open space for communities, and benefit the environment by filtering pollutants and promoting infiltration of runoff.

Both the CVM and HPM types of analysis, although very different, produced similar results. The authors believe that the similar results show that CVM can be a reliable tool if applied carefully. Regardless of the valuation method you prefer, the study showed that people are willing to, and do, pay more to live near a riparian buffer or other open space.

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## Riparian Restoration Benefits Exceed Costs in Little Tennessee River

Researchers in the Little Tennessee River watershed found that the economic benefits of restoring riparian areas far outweigh the costs needed to do so. The Little Tennessee River (LTR) watershed, located just north of Clayton, Georgia, is predominantly forested (86 percent), but is under increasing pressure from agricultural, commercial, and residential development. Concerns about water quality led the Natural Resources Conservation Service (NRCS) to initiate a watershed restoration program in 1995. Since then, the NRCS has restored 8.55 miles of riparian buffer along the LTR and its tributaries.

A 2000 study (Bergstrom et al.) showed that, on average, local residents were willing to pay \$37 per year to restore a two-mile stretch of the LTR (in 1996 dollars). A 2002 study (Kask and Orr) used this and other data to conduct a cost-benefit analysis of LTR restoration activities. Activities included planting buffers and installing revetments (large branches or small trees anchored to stream banks to provide protection from erosion). To determine costs, researchers looked at the actual costs of installing buffers and revetments. To determine benefits, Kask and Orr considered the value of restoration for the general public, and asked participating landowners to estimate the value of restoration in terms of decreased risk of erosion and flooding, better water quality, and improved aesthetics and wildlife habitat.

At the time of the study, Kask and Orr determined that the 8.55 miles restored along the LTR provided \$1.95 million in total benefits, at a cost of only \$242,569 in project expenditures. Each individual restoration project provided an average benefit of \$33,186, but only cost an average of \$4,353 (using onsite trees) to \$8,262 (bringing trees from offsite) for revetments and an average of \$606 (without fencing) to \$3,670 (with fencing) for buffers. The researchers calculated the social and private benefits from completing additional restoration at \$43.40 per foot, while additional costs would range from \$0.68 to \$16.95 per foot, leading the researchers to conclude that “additional restoration is beneficial to society from the project scale.” However, they caution that without public funding for this type of program, there is no guarantee that landowners would be willing to pay all restoration costs needed to provide the associated social and private benefits.

Related results published in 2004 (Holmes et al.) showed that the benefit/cost ratio for riparian restoration in the LTR ranged from 4.03 (for 2 miles of restoration) to 15.65 (for 6 miles of restoration), leading the authors to conclude that riparian restoration in the LTR is an economically feasible investment of public funds. This study also showed that the benefits of partial restoration exceeded their costs, indicating that “partial restoration should proceed with available funds.”

For more details on these studies, please consult the following papers:

- Holmes, T.P., Bergstrom, J.C., Huszar, E., Kask, S.B., Orr III, F. 2004. Contingent valuation, net marginal benefits, and the scale of riparian ecosystem restoration. *Ecological Economics*, 49, 19-30. (Available online at <http://econpapers.hhs.se/article/eeecolec>). Contact [tholmes@fs.fed.us](mailto:tholmes@fs.fed.us) for more information.)
- Kask, S.B., Orr III, F. 2002. *The economic benefits and costs of riparian restoration on the Little Tennessee River*. Final Report, USDA Southern Research Station contract FS-SRS-4851. (Contact [skask@warren-wilson.edu](mailto:skask@warren-wilson.edu) for more information.)
- Bergstrom, J., Holmes, T., Huszar, E., Kask, S. 2000. *Ecosystem valuation in southern Appalachians with applications to the Little Tennessee River Watershed*. Final report, USDA contract number SRS33-CA-99-713 and SRS33-CA-99-713. (Contact [jbergstrom@agecon.uga.edu](mailto:jbergstrom@agecon.uga.edu) for more information.)

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## News in Agriculture

### *Profiting from Agricultural BMP Implementation*

Agricultural BMPs often call for an initial investment, but can provide significant savings over time. Savings can be realized as money saved by sowing fewer seeds, using less fertilizer, spraying pesticides on a smaller portion of a field, or by achieving a greater efficiency of operations. Modern farmers and growers make use of many different technologies to increase the return on their crops.

#### *Nutrient Management Planning Pays Off*

Nutrient tests for soil and manure are valuable tools for farmers planning fertilizer purchases. Often, farmers spend money needlessly on fertilizer because they don't know how much fertilizer is already in the soil or how much is in the manure they spread on their crops. Nitrogen is usually the fertilizer applied most heavily in crop production, and manure from livestock provides a cheap, abundant source of nitrogen. Savvy farmers test the manure first to determine available nitrogen levels. Moreover, annual soil testing for nutrient levels is paramount, as nitrogen may remain in the soil from the previous year's crop, especially if legumes were grown. For corn producers, testing the soil in late spring when the corn is six to 12 inches high provides the most reliable readings of the amount of usable nitrogen, and is early enough in the growing season to correct any deficiencies by boosting nutrient levels sufficiently to generate optimal yields.

According to the 1990 USDA *Farm Costs and Returns Survey*, farmers used 22.2 billion nutrient pounds of nitrogen fertilizer in 1990. Priced at the 1990 average of 18.7 cents per pound, spending came to more than \$4 billion. A 1992 study by Babcock and Blackmer in the *Journal of Agricultural and Resource Economics* showed that a late spring soil test could reduce fertilizer application by 38 percent in Iowa, allowing farmers to significantly increase their net returns.

Another Iowa study of 200 farms conducted from 1991 through 1994 by Trachtenberg and Ogg showed that by keeping an account of nitrogen supplied from legumes and livestock, 52 percent of growers had saved a total of \$200,000 in nitrogen purchases, with a reduction of more than one million pounds of nitrogen loadings with no decrease in production.

#### *Prescription Farming*

Prescription farming accounts for the different conditions that typically occur across a single field. (See *NPS News-Notes* #41, June 1995, for an article on prescription farming.) Application of prescription farming (also known as precision agriculture), requires an accurate knowledge of where a piece of farm equipment is as it moves across a field, and a mapping of the particular conditions pertinent to the crop being grown. A Global Positioning System (GPS) locates within a few centimeters the exact position of equipment in a field, and a Geographic Information System (GIS) maps data on a grid corresponding to the position of the equipment. Technology costs can vary widely depending on the degree of program sophistication. For information on start-up costs and economic returns, see <http://precisionag.osu.edu/resources/> or [www.oardc.ohio-state.edu/fabe/precisionag/](http://www.oardc.ohio-state.edu/fabe/precisionag/).

Precision agriculture has been successfully applied to cotton production, thanks to the vision of Tim Sharp, head of the Precision Agriculture Department at Jackson State Community College in Jackson, Tennessee. Sharp explains, "Experimenting with different timings and applications, it became apparent that there were distinct zones within fields that could be managed using different strategies." So, when precision agriculture technology began to come on line, Sharp started looking for ways to make it work for cotton. "We always said, 'If it won't make money for growers, we won't do it.'"

Sharp based the program's path on a key fundamental assumption that every field can be zoned into areas of high, medium, or low productivity. Identification of these zones allows a grower to plant seed at variable rates, thus providing savings of seed money as compared with planting the

entire field at the same rate. GPS allows the planting equipment to recognize those areas and a computer varies the number of seeds planted accordingly.

Once a farmer has this necessary background information, precision agriculture advisors from Jackson State Community College formulate a plan for optimum cotton production that includes seeding amounts and pesticide and fertilizer application rates. Imagery recognition of lush growing zones locates high breeding spots of destructive insects early in the season and allows for spraying only about 20 percent of the field for insect control rather than the entire field. In addition to time and money saved by spraying only a small portion of a field, this strategy is a major plus for cotton farmers who must control bollworms and budworms. Spraying only 20 percent of the field leaves 80 percent free of spray for the development of a population of beneficial insects such as praying mantises and assassin bugs which will control the remaining bud and boll worms. Yet another feature of zone recognition encourages optimum cotton boll development, and more return on the crop. Farmers can spray to reduce the height of high zone production plants, causing the plant to put more energy into developing a larger cotton boll.

### *Automated Steering Systems*

Installing an automatic steering system on three tractors cost two Ohio farmers, Tom and Ed Miller, just under \$60,000. The system essentially eliminates human error while driving through fields—it ensures that the tractor drives in a straight line with no overlapping or skipping of rows. The driver is only responsible for end-row turns. “We strip-till corn,” says Tom, “and we estimate we will save 10 to 20 percent just on time spent going through the field. That’s not only time but fuel costs and wear and tear on the equipment.” Strip-till means that crops are planted and grown in narrow slots or tilled strips established in the untilled bed of the previous crop.

Now that they’ve upgraded their tractors, the next step will be to add automatic steering to their combines, delivering greater harvesting efficiency. “With beans,” says Tom, “we expect to see between 16 and 20 percent increase in efficiency in harvesting as well as tillage. The cost will be about \$20,000 per unit, but will be well worth it.” The Millers estimated that between cost savings and improved efficiency the new technology will pay for itself in two years.

Researchers in the National Air and Space Administration, U.S. Department of Agriculture (USDA), and U.S. Geological Survey are working cooperatively to improve this fledgling technology. USDA estimates there are 2.1 million U.S. farms using 941 million acres of land with production worth \$200 billion a year. As Doug Rickman wrote in the November 2003 *Geotimes*: “Agriculture is a huge portion of our economy. Just a 1 percent increase in efficiency is a \$2 billion change. We all depend on farmers, literally, for the bread we eat. No other human activity on land matches the impact of farming. If the development of precision agriculture can help farmers better manage their land, we may all benefit.”

*[Case studies in Tennessee and Ohio were adapted from a report by Paul Schrimpf, published in PrecisionAg Special Reports, 2003 ([www.precisionag.com](http://www.precisionag.com)). For more information, contact [paul\\_schrimpf@meisternet.com](mailto:paul_schrimpf@meisternet.com).]*

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## *Ensuring Economic Returns in the Mad River Watershed*

Ohio State University Extension wants some farmers in the Mad River watershed to get more for less. In 2002 Ohio State University (OSU) Extension implemented a grant-funded nitrogen (N) reduction program that includes a BMP “net returns performance warranty” in the Kings Creek watershed, a tributary of the Mad River. The program entices operators to adopt OSU Extension’s tri-state N recommendations, which suggest applying less N than most operators typically apply. OSU Extension hopes that this project will convince operators that, in most cases, N application at the recommended rate will not significantly reduce corn yields, will actually save money on fertilizer purchase, and can help reduce nitrate pollution in groundwater.

The N reduction program protects the operator who is skeptical of applying less N by guaranteeing the net returns of the crop. Program participants apply N to their enrolled crop acres following OSU's recommended rates, but also plant a check strip utilizing their normal N application rates (see table 3). OSU compares yields of the two areas at the end of the growing season. OSU Extension compensates cooperators for loss of income if the tri-state N recommended rate yields a lower net return than the higher N rate.

**Table 3. Nitrogen Reduction Program Results**

| Year | Total acres in program | Avg N applied on enrolled acres (lbs/ac) | Avg N applied on check strips (lbs/ac) | Yield: enrolled acres *(B/ac) | Yield: check strip (B/ac) | Net return: enrolled acres (\$/ac) | Net return: check strip (\$/ac) |
|------|------------------------|--|--|-------------------------------|---------------------------|------------------------------------|---------------------------------|
| 2002 | 150                    | 159                                      | 194                                    | 92                            | 93                        | \$175                              | \$170                           |
| 2003 | 226                    | 156                                      | 198                                    | 173                           | 177                       | \$358                              | \$357                           |
| 2004 | 238                    | 159                                      | 225                                    | 186                           | 197                       | \$434                              | \$448                           |

\*B/ac= Bushels per acre

### Program Results

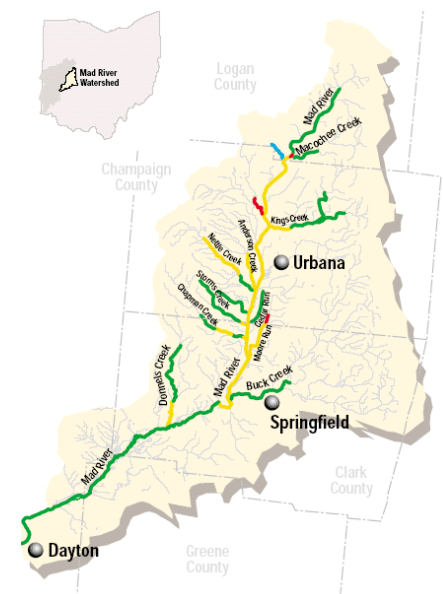
After three growing seasons, the program results are mixed. In all growing seasons, check strip yields actually exceeded that of enrolled acres (see table). However, during 2002 and 2003, enrolled acres yielded a higher net return (\$5/ac and \$0.51/acre, respectively) because operators purchased and applied less fertilizer. In 2004, check strip yields exceeded those on enrolled acres by more than 11 bushels/acre, providing farmers with \$14/acre more on check strips than on the enrolled acres.

### Farming is an Inexact Science

The variability in yields and net returns is likely due to unpredictable weather in the area, explains Jennifer Ganson, Mad River Watershed Coordinator. "The weather has gone from very wet to very dry—often during the same growing season. The timing of these weather extremes can play an important role in overall productivity." Average yields in 2002 were almost half of what is expected because cool, rainy weather delayed planting, and wet soil conditions during emergence and early vegetative growth resulted in restricted, shallow root systems. The wet weather was followed by a drought that began in mid June and severely reduced yields.

Ganson believes the drought in 2004 is an example of why farmers typically apply more fertilizer every year. "Farmers rely on their crops for their livelihood. They often plan for the worst-case scenario to ensure the best yields possible." In 2004 the higher levels of N applied on the check strips actually paid off because the rain that did fall carried a larger amount of N to the root zone at one time. In normal years, rainfall would carry the lower, recommended levels of N to the root zone many times throughout the growing season, sufficiently meeting the plant's needs.

Because the average return on check strips in 2004 exceeded that of enrolled acres by \$14 per acre, all participating farmers qualified for compensation under the program. OSU paid a total of \$3,510, noted Ganson, which is "a small price to pay when you consider how much less nitrogen was applied to the watershed during the past three years. This program shows that, in most cases, farmers can make more money by applying less nitrogen."



Ohio's Mad River watershed (image courtesy of Miami Conservancy).

The current program is funded for one more year; a grant application requesting program renewal is pending. Ganson hopes the program will continue to allow OSU to gather additional data. Data on a greater number of growing seasons will ensure a more representative overview of the viability of OSU Extension's tri-state N recommendations.

[For more information, contact Jennifer Ganson, Mad River Watershed Coordinator, The Ohio State University Extension, 1512 S. U.S. Hwy. 68, Suite B100, Urbana, Ohio 43078; Phone: 937-484-1526; E-mail: [ganson.6@osu.edu](mailto:ganson.6@osu.edu).]

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## Agricultural Payments Linked to Water Quality Improvement

Enticing farmers to implement best management practices (BMPs) in exchange for monetary compensation is nothing new. But what if those farmers had to show that the BMPs actually improved the water quality flowing from their land before they received their money? That is exactly the scenario soon to play out in two small Ohio watersheds. In an EPA-funded pilot project, farmers have agreed to implement structural or management BMPs and defer the full compensation for these practices until monitoring data show that water quality improvement goals have been met. In this case, nonpoint source controls will yield economic benefits—but only if the controls really work and are implemented efficiently.

This six-year project is in its second year, and the exciting part—learning whether it will be successful—is still a year away. The project represents a broad collaboration between Ohio State University Extension, the Stillwater Watershed Project, the Dark Soil and Water Conservation Service, the USDA Natural Resource Conservation Service, the Miami Conservancy District, and the participating farmers. It is funded as part of the 2003 Great Miami River U.S. EPA Watershed Initiative Grant. The collaborators chose to implement the pilot project in two small subwatersheds (less than 1000 acres each) of Stillwater Creek, a tributary of southwestern Ohio's Great Miami River. Project staff members are currently collecting background water quality data. They have held numerous meetings to share the data with the farmers, educate them about the project, and solicit their participation.

### How Will it Work?

Participating farmers bid for contracts with OSU. The farmers agree to adopt management and/or structural BMPs, and will receive annual payments tied to measured changes in annual nitrogen, phosphorus, and/or sediment loads in the stream. In their bids, farmers specify their proposed reduction in pollutants, and the payment they want in exchange for their efforts. They do not need to specify what BMPs they will implement. Farmers will work with local conservation personnel or consultants to develop their plans for reducing nutrients, and to estimate the costs of providing these reductions. OSU has approximately \$300,000 to spend contracting with farmers.

#### Want more information?

A paper providing more detail about the project is available at [yosemite.epa.gov/ee/epa/eerfile.nsf/vwAN/EE-0472-01.pdf](http://yosemite.epa.gov/ee/epa/eerfile.nsf/vwAN/EE-0472-01.pdf).

Project staff will look at the bids and, based on what the farmers say they can achieve, establish aggregate water quality targets for each subwatershed. Determining the water quality leaving individual farms is cost-prohibitive, so OSU will monitor the water downstream of the group of farmers in the subwatershed and tie payments to group performance rather than individual performance. Obviously, farmers will need to work together and support each other's efforts to achieve maximum nutrient reductions and receive full compensation.

Each group of farmers will have three years to reach its target pollution reductions, explains project coordinator Brent Sohngen, an economist with The Ohio State University (OSU), Department of Agricultural, Environmental, and Development Economics. "Right now, we are planning to have a goal that meets ten percent of the target the first year, 30 to 40 percent the second year, and the full target the third year." Payments to the farmers will be allocated according to a similar schedule. Increasing the amount of reduction over time "allows farmers to become more familiar with what BMPs work best," Sohngen added. Each contract will be negotiated to include clauses

that limit financial losses from the contract if severe weather interferes. Farmers will receive an initial payment to get started, and can expect payments each year as long as the aggregate target for all farmers in the small watershed is met. No payments will be made in years when the aggregate target is not met.

Not all farmers in each project watershed have to participate to make the project work. In fact, Sohngen expects only about 75 percent of the land to have farmers participating. "As long as the non-participating farmers don't make any significant changes to their farming practices, our results will be valid." Sohngen notes that they have a good relationship with all the watershed farmers, but that some have chosen to simply not participate.

### Water Quality Trading and Performance-Based BMPs

Performance-based contracts open up the possibility for more widespread water-based pollution trading. In any trading system, debits and credits must involve known quantities of pollution. Performance-based contracts provide known pollution reduction quantities, and compliance is encouraged with monetary incentives rather than through less popular regulatory channels.

### What's in it for Farmers?

Getting farmers to agree to performance-based contracts on a broad scale will likely be a challenge, noted Sohngen, especially since the traditional cost-share programs don't carry a risk of non-payment if the BMPs don't improve water quality. However, he noted, "farmers can realize a profit with performance-based contracts if they discover a way to meet their targets without spending all the money they thought they'd need." The farmers in the pilot project are willing to participate for the sake of being involved in "something bigger than themselves," he added. "They understand the benefit of the research, and the profit motive helps to keep them interested."

Unlike many traditional cost-share programs, the pilot project will not pre-select BMPs for implementation. Rather, farmers will have the freedom to choose which practices they believe would be most successful. Sohngen expects farmers to implement lower-risk, inexpensive changes in management, such as shutting off tile drains or modifying when and how much manure is spread on the fields. "If the group of farmers is unable to meet the target outlined in the contract, no farmer wants to be left paying for a \$100,000 manure storage pit," he explained. By specifically tying cost-share payments to performance, farmers will have more incentives to assess their overall farm practices, and discover inexpensive modifications that benefit the environment.

### What Happens at the Project's End?

Project staff plan to continue the project if they can secure additional funding. If not, Sohngen hopes to keep monitoring the stream to see whether the project has long-term impacts. "Even if the farmers revert back to their original practices and the nutrient levels in the stream return to pre-project levels, at least the project will have shown that this approach can work," he explained. However, he anticipates that farmers will discover very inexpensive ways to reduce nutrient pollution, and that they will continue to use their modified practices after the project is over. "Some farmers will probably discover cost-savings that they didn't know were there, such as a reduced need for application of purchased fertilizer." For this reason, the project has the potential to offer long-term benefits both for farmers' wallets and local water quality.

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## Beyond Environmental Compliance: Stewardship as Good Business

Growing evidence suggests that good economic performance is compatible with good environmental performance. For example, firms in the Dow Jones Sustainability Index (companies that incorporate environmental and societal concerns into their long-term economic investment strategies) outperformed the 2,500 largest capitalized companies that make up the Dow Jones Global Index. Specifically, between 1993 and 2003, the Sustainability Index saw cumulative gains in nominal market value of 85 percent, compared with 57 percent from the Global Index. The positive correlation between environmental and economic performance is especially apparent in

industrial sectors with substantial exposure to environmental risk. This evidence challenges the traditional notion that complying with environmental regulations saps profitability and suggests that going “beyond compliance” can result in a competitive advantage. For example, firms with better environmental records may be more attractive to investors due to reduced compliance costs and a lower risk of future liabilities.

Recent analysis by the USDA Economic Research Service (ERS) suggests that agricultural producers can also benefit economically by voluntarily adopting environmentally beneficial practices. An efficient farm would naturally minimize unnecessary applications of pesticides and fertilizer, enhancing the bottom line as well as minimizing environmental impacts. But additional incentives may exist for farms to invest in environmental management. For example, those producers who accurately anticipate regulations or changes in consumer tastes for food grown with environmentally friendly technologies could gain a competitive advantage in the marketplace. In other words, incentives facing agriculture are not that different from those facing other firms trying to plot a sustainable growth path.

### *Economic Advantage of Crop Residue Management*

Specifically, ERS research found this to be true for U.S. corn producers who use crop residue management (CRM) to minimize damages from agricultural runoff. These producers enjoy a clear economic edge over non-CRM corn producers. The ERS study found that the average total resource cost (which includes land and operator labor costs as well as material inputs) across all farms producing corn was \$1.78 per dollar of output. The average was 31 cents lower for CRM corn farms versus non-CRM corn farms. For more detailed information about this study, see [www.ers.usda.gov/Amberwaves/April04/Features/BeyondEnvironmental.htm](http://www.ers.usda.gov/Amberwaves/April04/Features/BeyondEnvironmental.htm).

#### **What is Crop Residue Management (CRM)?**

Conventional or “clean tillage” practices turn over soil in order to clear away the remains of the previous crop and prepare the seedbed prior to planting. With CRM, the producer plants the new crop directly into residue from the previous crop. This practice has been used for several decades because it reduces planted areas and yields only slightly, yet significantly decreases soil loss and agricultural runoff relative to conventional tillage. Agricultural engineers estimate that soil erosion can be reduced by a third if 15 percent of afterharvest residue from corn is left on the field rather than turned under by tilling. Use of CRM sometimes requires higher pesticide use, in which case reduced soil erosion must be weighed against a greater potential for pesticide runoff.

A number of studies have noted that CRM tends to lower costs of labor, equipment, and fuel in corn production, and that these cost savings more than offset any declines in crop yields and/or the need for increased pesticide use. The gap in economic efficiency is observable not only at the mean, but among both lowest cost and highest cost farms as well. Of course, economic efficiencies vary widely among both adopters and non-adopters of CRM due to underlying differences in management and growing conditions. Along the full range of corn farms, those that employ CRM are more efficient than those that do not. In general, the gap in efficiencies between the two groups grows as total costs per dollar of output increase.

In the corn sector, many farmers are employing crop residue management practices voluntarily. Although, in part, CRM use is likely the result of the desire to maintain eligibility for farm program payments, CRM also brings demonstrable efficiency gains to farmers. So why have 40 percent of the corn farms

sampled not adopted this technology? For one, farmers may consider the benefits small relative to other ways that can improve profitability. Moreover, year-to-year fluctuations in costs and returns may obscure the returns to CRM. The technology may also be less suited to some regions and soil types. In particular, CRM adoption rates have been lower in colder and wetter climates. However, ERS results indicate that even in these areas, corn producers adopting CRM on their corn acres were no less profitable than non-adopters.

#### **Exploring Economic Benefits of No-Till and Conservation Buffers**

In 2001, the Conservation Technology Information Center released an educational brochure titled *Economic Benefits with Environmental Protection: No Till and Conservation Buffers in the Midwest* (available at [www.ctic.purdue.edu/ctic/final.pdf](http://www.ctic.purdue.edu/ctic/final.pdf)). This report explores how no-till and conservation buffers—especially when used together—have proven to be not only economically beneficial, but also efficient and effective tools for reducing erosion, protecting the quality of surface and ground water, and providing habitat for a variety of wildlife species.

The data behind the ERS survey, although extensive, are unfortunately not comprehensive enough to control for everything affecting farm profitability, and some of these factors could help explain non-adoption. Farmers ultimately make bottom line decisions in a context that includes not only market conditions but also regulations, voluntary incentive programs, and household goals and objectives. While the findings indicate that many farmers will choose to go beyond compliance with program requirements, whether most farmers go “far enough” to meet broader environmental objectives remains an open question.

[The article was excerpted with permission from the April 2004 issue of *Amber Waves*, a magazine published by the U.S. Department of Agriculture, Economic Research Service. To view the article in its entirety, see [www.ers.usda.gov/Amberwaves/April04/Features/BeyondEnvironmental.htm](http://www.ers.usda.gov/Amberwaves/April04/Features/BeyondEnvironmental.htm). For more information, contact the authors: Jeffrey Hopkins at [jhopkins@ers.usda.gov](mailto:jhopkins@ers.usda.gov) or Robert Johansson at [rjohanss@ers.usda.gov](mailto:rjohanss@ers.usda.gov).]

## Notes on Education

### Watershed Education Pays Off for the Hackensack River

Hackensack Riverkeeper's Eco-Programs generate funds by combining river recreation with watershed education. The Eco-Programs, which include Eco-Cruises (pontoon boat cruises), Eco-Paddles (guided paddling trips and canoe / kayak rentals) and Eco-Walks (guided naturalist hikes), provide the public with an up-close look at the lower Hackensack River and its watershed. Participants are asked to donate anywhere between \$5 and \$25 each, depending on the Eco-Program and the age and number of people taking part.



Hackensack Riverkeeper's pontoon boat sets out on an Eco-Cruise.

The lower Hackensack River wouldn't strike many people as the ideal location for a nature retreat. The 45-mile long river begins in southeastern New York State and flows across mostly suburban and urban northeastern New Jersey. Nearly 20 million people live within a short drive or train ride from its banks. Before the passage of the Clean Water Act in 1972, the river served as an open sewer for human and industrial wastewater, and its wetlands served as a regional garbage dump. Pollution from these activities remains buried in the sediments today and continues to seriously restrict the local fishery. The river's greatest ongoing pollution threat is nonpoint source pollution (trash and chemicals) carried by stormwater flowing off of lawns, parking lots, and streets. In the Hackensack watershed, as in most communities across the nation, local conservation groups like

Hackensack Riverkeeper are leading the effort to educate the public about the value of their local water resource.

#### *Getting Back to Nature*

Hackensack Riverkeeper's Eco-Programs are central to its mission to restore river-based recreation on the Hackensack and to educate visitors about the river, the impact of nonpoint source pollution, and ways they can help restore and protect it. “Eco-Program participants are often very surprised to find such a beautiful natural resource in this urban area,” explained Captain Bill Sheehan, Hackensack Riverkeeper's executive director. “They learn about our efforts to protect the river and are motivated to help. Some actively contribute to making the river a nicer place by taking part in our river clean ups. Others recommend our Eco-Programs to their friends. Participation keeps growing every year.”

This circle of success has generated more and more money for the Hackensack Riverkeeper. Last year, the Eco-Programs provided enough profit to fund an entire full-time staff position (approximately \$40,000). “Our program more than pays for itself, plus we are able to educate countless people about the river,” added Sheehan.

#### What is a Riverkeeper?

Hackensack Riverkeeper is part of the Waterkeeper Alliance, an international association that connects and supports local Waterkeeper programs (with names like Riverkeeper, Lakekeeper, Baykeeper, Coastkeeper, etc., depending on the type of water resource being protected). Waterkeepers provide a voice for waterways and their communities worldwide. For more information on Waterkeeper programs, see [www.waterkeeper.org](http://www.waterkeeper.org) or refer to News-Notes Issue #69 at [www.epa.gov/newsnotes/issue69/69issue.pdf](http://www.epa.gov/newsnotes/issue69/69issue.pdf).



## Raising the Visibility of the River

In 2004, Hackensack Riverkeeper reached almost 16,000 people through its Eco-Programs and public outreach efforts.

- More than 3,300 people participated in 208 Eco-Cruises on Riverkeeper's two specially rigged pontoon boats.
- More than 1,550 people paddled canoes or kayaks either on guided tours or by renting boats for independent exploration. Riverkeeper runs the only boat rental business on the Hackensack River.
- More than 750 people participated in 48 Eco-Walks.
- Volunteers provided nearly 1,100 hours during 12 river clean-ups. They removed trash from 17 miles of river—enough to fill 25 dumpsters.
- Hackensack Riverkeeper staff members, including dedicated AmeriCorps volunteers, had face-to-face encounters with approximately 10,000 people through presentations, seminars, and other special events.

Capt. Sheehan started the Eco-Cruise program in 1994 (three years before he founded Hackensack Riverkeeper) to supplement grassroots efforts to restore and protect the river. Since then, Riverkeeper and its programs have grown and expanded through many generous grants and donations, which help offset the cost of boats and staff time. Over the past ten years, both the river's water quality and Eco-Program participation rates have steadily improved, explains Hugh Carola, Hackensack Riverkeeper's program director. "Many people have told me how much cleaner the river has gotten over the past 10 years—so we are all doing something right." He attributes the improvements to a combination of factors: the Riverkeeper's river clean ups, their public education efforts on and off the river, outreach efforts by other local conservation organizations, more environmental education available in the schools, and more stringent stormwater regulations now in place for municipalities.



**A group of kayakers enjoy a Hackensack Riverkeeper Eco-Paddle through marsh grasses.**

## Reaching Beyond the Locals

The Hackensack is no longer just for New Jersey residents. The number of Eco-Program participants from outside of the watershed is growing, notes Carola, "More tourists means more dollars being introduced into our local economy." He sees an increasing number of participants from New York City, located just across the Hudson River to the east. Hackensack Riverkeeper is working with local travel companies to establish Eco-Programs as an option in bus tour packages put together for people visiting New York City. "Many people stay in New Jersey to keep costs down. They opt to take bus tours to see the sights in New York City. We would like them to see the City one day, and then come visit us on another!"

Carola foresees that the Hackensack and the wetlands associated with it can become a bird-watchers and nature-lovers destination, bringing in extra tourist dollars. Recently a local land trust acquired the Empire Tract—587 acres of wetlands on the lower Hackensack River. The area will be turned into a nature preserve, pushing the dream of creating a major tourist destination a step closer to reality. In the meantime, Hackensack Riverkeeper's Eco-Programs will continue to educate and enthrall children and adults alike. Riverkeeper staff and supporters can be proud that their investment in education and outreach is paying such large returns for both the organization and the river itself.

## Ecotourism Helping to Keep New Jersey Green—and in the Black

New Jersey's 39 state parks and 11 state forests provide economic benefits amounting to at least \$1.2 billion per year, or \$30 billion over a 25-year period, according to a study released in October 2004 by the NJ Department of Environmental Protection (DEP), Division of Science, Research, and Technology. The study, *The Economic Value of New Jersey State Parks and Forests*, highlights that the state's parks and forests create almost 14,000 jobs, positively impact property values, and provide enhanced public services including education. According to the study, New Jersey's parks and forests annually provide \$812 million in benefits from recreation and tourism, including the indirect economic activity generated by recreation and tourism expenditures. In addition, the almost 400,000-acre park system annually provides benefits of \$228 million from the operating and capital expenditures for the state parks and forests, including the indirect economic activity that those expenditures generate. Benefits worth at least \$140 million are annually derived from the parks system's ecosystem services, such as watershed and groundwater protection, flood control, water purification, wildlife conservation, biodiversity preservation, and storage of carbon, the leading greenhouse gas.

"And that's really just the half of it here in New Jersey," said Hugh Carola, Hackensack Riverkeeper's program director. "In addition to state parks and forests, there are over 210,000 acres of state wildlife management areas, nearly 140,000 acres of federally protected lands, and thousands more acres of natural open space owned by counties, municipalities, and private conservancies – all of it helping the economy as well as the environment."

A soon-to-be-created nature preserve along the Hackensack River is expected to generate a tremendous amount of indirect economic activity from the "ripple effect" that will spread as a result of increased consumer spending related to ecotourism in the region. The effect is pretty simple: when nature preserve visitors purchase things like food, lodging, and gas, the local businesses that provide those goods make money as do their employees and suppliers. Everybody wins. For more information, see [www.state.nj.us/dep/newsrel/2004/04\\_0121.htm](http://www.state.nj.us/dep/newsrel/2004/04_0121.htm).

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## Environmental Education Provides Extensive Benefits

In February 2002 the Washington State legislature's House and Senate Education Chairs asked the Governor's Council on Environmental Education to review and report on the status of environmental education in Washington. Specifically, the request asked for an analysis of the current status, funding needs, and potential revenue sources for environmental education (EE). The resulting *Report Card on the Status of Environmental Education in Washington State* featured successful EE examples from around the state, and explored why these EE opportunities benefitted the students. The report concluded that, to maximize the benefits available from EE, Washington State needs to develop a better funded, more comprehensive approach to EE. To review the report, see <http://wa.audubon.org/new/audubon/userdocuments/EEReportCard.pdf>.

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## Reviews and Announcements

### *"After the Storm" Now Available for Local Broadcasts*

A half-hour television special about watersheds and stormwater runoff is now available for broadcast on television stations or in classrooms. "After the Storm," co-produced by the U.S. Environmental Protection Agency and The Weather Channel, explores how polluted runoff threatens the nation's waters. EPA now owns full rights to "After the Storm" and is making the TV show available to the public for free. EPA encourages watershed groups and others to work with their local cable and other TV stations to air the half-hour program (22 minutes without commercial breaks). The program can be used by communities to educate citizens as part of their stormwater management program. Copies are available by contacting the National Service Center for Environmental Publications (NSCEP) at 513-489-8190 or 800-490-9198 or by sending an e-mail to [ncepimal@one.net](mailto:ncepimal@one.net). Please request "After the Storm," refer to document number EPA 840-V-04-001, and specify VHS or Beta SP (for cable and other TV stations) format. For more information, visit [www.epa.gov/weatherchannel/](http://www.epa.gov/weatherchannel/).

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### *BASINS 3.1 Water Quality Model Released*

EPA just released the newly updated Better Assessment Science Integrating point and Nonpoint Sources (BASINS) software system. BASINS is multi-purpose environmental analysis system that integrates a geographical information system (GIS), national watershed data, and state-of-the-art environmental assessment and modeling tools into one convenient package. Like the previous release, the new BASINS 3.1 includes a data extractor, geographic coordinate projector, project builder, GIS interface, various GIS-based tools, a series of models, and custom databases. But instead of including the data on multiple CDs as in version 3.0, data are now available entirely through a web data extraction tool. This web data extractor provides a tool for dynamic downloading of GIS data and databases from the BASINS web site and a variety of other sources. This feature will help ensure that BASINS users are working with the most up-to-date data sets for their projects. Other significant enhancements in version 3.1 include updated data holdings, a new tool to archive and restore BASINS projects, a tool to update the BASINS software interactively, and several new modeling capabilities. For more information, and to download BASINS 3.1, visit [www.epa.gov/waterscience/basins](http://www.epa.gov/waterscience/basins).

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### *DoD LID Design Manual Unveiled*

In October 2004, the Department of Defense (DoD) published *Design: Low-Impact Development Manual* (document number UFC 2-210-10). This manual was created as part of the Unified Facilities Criteria (UFC) document series that provides planning, design, construction, sustainment, restoration, and modernization criteria for military departments, defense agencies, and DoD field activities. The Low-Impact Development (LID) manual provides guidance for integrating LID planning and design into a facility's regulatory and resource protection programs, and is one of three accepted standard approaches for designing and building DoD projects. The document is available for download at [www.ccb.org/docs/UFC/3\\_210\\_10.pdf](http://www.ccb.org/docs/UFC/3_210_10.pdf).

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### *Economic Valuation of Wetlands Paper Now Online*

In this paper, titled *Economic Valuation of Wetlands: an Important Component of Wetland Management Strategies at the River Basin Scale*, author Alain Lambert defines economic valuation and discusses the most common quantitative wetland evaluation methods used. The paper was developed for the May 2003 Ramsar Convention on Wetlands and is available for viewing at [www.ramsar.org/features\\_econ\\_val1.htm](http://www.ramsar.org/features_econ_val1.htm).

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### *EPA Report Reviews Economic Benefits of Runoff Control*

Available at [www.epa.gov/nps/runoff.html](http://www.epa.gov/nps/runoff.html), this 1995 EPA report describes how certain urban runoff management controls can be incorporated into a development in a way that provides aesthetic and economic benefits.

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### *Guidebook Reveals the Economic Value of Protecting the Great Lakes*

*Revealing the Economic Value of Protecting the Great Lakes*, published in 2001 by the Northeast Midwest Institute, presents economic analysis of environmental benefits in the Great Lakes region. The guidebook describes how economic benefits assessment ties into environmental regulations and decision-making in the Great Lakes region and nationally, the various methods available for accounting of environmental benefits, and case studies illustrating each method. The report is available for download at [www.nemw.org/GLEconVal.pdf](http://www.nemw.org/GLEconVal.pdf).

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### *Reports Review Value of Wetlands*

Dr. Richard Kazmierczak of Louisiana State University's Agricultural Center compiled results from existing wetland values studies into a series of three reports. The following reports, available for download at [www.agecon.lsu.edu/faculty\\_staff/FacultyPages/Kazmierczak](http://www.agecon.lsu.edu/faculty_staff/FacultyPages/Kazmierczak), provide estimates of wetland values for habitat protection, water quality, and hunting and fishing.

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(1) *Economic Linkages Between Coastal Wetlands and Habitat/Species Protection: A Review of Value Estimates Reported in the Published Literature* (2001), summarizes eight peer-reviewed studies published from 1975 to 2001, reporting 24 separate estimates for the value of habitat and species protection services provided by coastal and non-coastal wetlands (file name: SP2001-04\_Habitat.pdf).

(2) *Economic Linkages Between Coastal Wetlands and Water Quality: A Review of Value Estimates Reported in the Published Literature* (2001), summarizes 12 peer-reviewed studies, published from 1981 to 2001, reporting 28 separate estimates for the value of water quality services provided by coastal and non-coastal wetlands (file name: SP2001-02\_Water\_Quality.pdf).

(3) *Economic Linkages Between Coastal Wetlands and Hunting and Fishing: A Review of Value Estimates Reported in the Published Literature* (2001), summarizes 12 peer-reviewed studies, published from 1978 to 2001, reporting 32 separate estimates for the value of hunting and fishing services provided by coastal and non-coastal wetlands (file name: SP2001-03\_Fishing.pdf).

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### Source Water Protection Handbook Now Available

This handbook, *Source Protection: Using Land Conservation to Protect Local Drinking Water Supplies*, provides local governments, water suppliers and agencies, and community drinking water advocates with the tools to identify source water conservation opportunities, implement funded source water conservation programs, and acquire and protect the lands that will help keep drinking water clean. The 88-page spiral-bound publication was produced by the Trust for Public Land (TPL) and the American Water Works Association (AWWA), and can be purchased for \$25 on TPL's Web site ([www.tpl.org](http://www.tpl.org)). The first chapter is available for free download for a limited time at [http://tpl.org/content\\_documents/TPLSPH\\_chapter1.pdf](http://tpl.org/content_documents/TPLSPH_chapter1.pdf).

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### Will Water Quality Trading Advance Your Watershed's Goals?

EPA has just released a new publication: *Water Quality Trading Assessment Handbook: Can Trading Help Advance Your Watershed's Goals?* The handbook is intended to help users evaluate whether the circumstances in a particular watershed make it likely or unlikely that trading can be effectively implemented on a watershed basis to address existing water quality problem(s). Water quality professionals and stakeholders are increasingly interested in water quality trading, but need assistance answering questions such as "How do you know when and where trading is the right tool?" and specifically, "Will water quality trading work in this watershed?" The handbook helps to answer these questions for any given watershed, providing a simplified analytical framework that can be used to assess the conditions and water quality problem(s) in a watershed and determine whether trading might be effectively used to meet TMDL allocations or other pollutant "caps." The handbook and fact sheet are available in PDF format at [www.epa.gov/owow/watershed/trading/handbook](http://www.epa.gov/owow/watershed/trading/handbook). Hard copies may be ordered free of charge from the National Center for Environmental Publications at 800-490-9198 or [www.epa.gov/ncepihom](http://www.epa.gov/ncepihom) (document number EPA 841-B-04-001).

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### WWF Report Explores Economic Values of the World's Wetlands

This 32-page report, prepared in 2004 by the World Wildlife Fund with support from the Swiss Agency for the Environment, Forests, and Landscape, explores the economic value of global wetlands. The report is available for download at <http://panda.org/downloads/freshwater/wetlandsbrochurefinal.pdf>.

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## Recent and Relevant Periodicals Articles

### *Downstream Economic Benefits from Storm-Water Management*

The November/December 2004 issue of the *Journal of Water Resources Planning and Management* features this article by J. B. Braden and D. M. Johnston. The authors assessed the downstream economic consequences of incorporating onsite water retention development designs. They

concluded that onsite retention provides valuable downstream services, including flood mitigation and water quality protection. These services increased downstream floodplain property values – by up to five percent for flood mitigation and up to 15 percent for improved water clarity. The authors estimate the total average benefits to floodplain property owners to be two to five percent of property value. See <http://ascelibrary.aip.org/wro> for a complete abstract.

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### *Economic Value of Lakes*

In Fall 2003, the North American Lake Management Society devoted an entire issue of their *LakeLine* magazine to the “Economic Values of Lakes.” See [www.nalms.org/lakeline/1123-03.htm](http://www.nalms.org/lakeline/1123-03.htm) for issue content and ordering information.

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### *Limiting Dead Zones*

The June 12, 2004 (Vol. 165, No. 24 , p. 378) issue of *Science News Online* features this article by Janet Raloff. She discusses the cause and economic and ecological impacts of the Gulf of Mexico’s “dead zones”—areas that become devoid of oxygen and life because of nutrient pollution. Raloff discusses a number of ongoing efforts to curb nutrient pollution in the Mississippi River watershed, including:

- Offering farmers insurance to reduce the amount of nitrogen they apply to their crops—farmers receive compensation if their yields suffer as a result. (For an example of a BMP insurance program, see the article “Ensuring Economic Returns in the Mad River Watershed,” located earlier in this issue.)
- Implementing controlled drainage, allowing farmers to reduce the amount of water flowing from fertilized fields
- Diversifying crops to create field cover year-round
- Implementing “nutrient farming,” the practice of renewing or creating wetlands to soak up nitrate from the water column.

See: [www.sciencenews.org/articles/20040612/bob9.asp](http://www.sciencenews.org/articles/20040612/bob9.asp).

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### *Natural Capital*

The Winter 2005 issue of American Forest’s quarterly newsletter, *American Forests*, features this article by Todd Wilkinson. Wilkinson discusses the economic and social values of nature, and notes the growing awareness that forests and trees provide untold economic benefits related to water quality protection and wildlife habitat. He highlights a number of communities that are focusing on forest preservation and urban forest renewal to help manage stormwater, protect wildlife, and save money on water treatment. See [www.americanforests.org/productsandpubs/magazine/archives](http://www.americanforests.org/productsandpubs/magazine/archives) for a copy of the article.

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### *Reengineering the Mississippi*

The July 2004 issue of *Civil Engineering Magazine* features this article by Dominic Izzo, P.E., the principal Deputy Assistant Secretary of the Army for Civil Works from 2001 to 2002. Izzo discusses the economic and ecological ramifications of the shrinking of the Mississippi River Delta, attributed largely to the removal of sediment from the water column by dams located along the river. He describes the need to implement the 30-year, \$14 billion comprehensive Louisiana Coastal Area Program to reverse the damage and avoid the need to spend more than \$100 billion in infrastructure alone over 30 years. See: [www.pubs.asce.org/ceonline/ceonline04/0704feat.html](http://www.pubs.asce.org/ceonline/ceonline04/0704feat.html).

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### *Streambank Stabilization: An Economic Analysis from the Landowner’s Perspective*

The November/December 2004 (Vol. 59, No.6) issue of the *Journal of Soil and Water Conservation* features this article by J.R. Williams, P.M. Clark, and P.G. Balch. The authors performed an economic analysis of streambank stabilization projects on the Little Blue River in Washington County, Kansas. The results show each project offers annual values ranging from \$126 to \$1,760

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with an average of \$781. Cost share payments are important for the landowner to benefit from the projects. For a complete abstract, see [www.swcs.org/en/publications/jswc/abstracts\\_and\\_archives/2004\\_abstracts/](http://www.swcs.org/en/publications/jswc/abstracts_and_archives/2004_abstracts/) and click on the link for “Nov-Dec 2004.”

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### *Successful Watershed Management*

The July/August 2004 (Vol. 59, No. 4) issue of the *Journal of Soil and Water Conservation* features a guest editorial by G. Tracy Mehan, III, a former assistant administrator for Water at the U.S. Environmental Protection Agency. Mehan discusses the water quality improvement over the past 30 years, explores current water quality challenges presented by nonpoint source pollution, and emphasizes the importance of properly pricing and investing in the nation's water infrastructure (pipes and treatment plants). To underscore how undervalued water infrastructure is in the United States, Mehan cites that U.S. households spend an average of \$707 per year on soft drinks and other beverages, compared to an average of \$474 per year on drinking water and wastewater charges. For information on obtaining a copy of the publication, see [www.swcs.org/en/publications/jswc](http://www.swcs.org/en/publications/jswc).

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## **Web Sites Worth a Bookmark**

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### *Economic Research Service (ERS)*

[www.ers.usda.gov](http://www.ers.usda.gov). The ERS is the main source of economic information and research from the U.S. Department of Agriculture. ERS research informs and enhances public and private decision-making on economic and policy issues related to agriculture, food, natural resources, and rural development. In particular, the ERS offers in-depth discussions of topics such as irrigation and water use, land use, manure management, organic agriculture and production, rural amenities and urbanization, soil conservation, water quality, wetlands, and wildlife.

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### *Ecosystem Valuation*

[www.ecosystemvaluation.org](http://www.ecosystemvaluation.org). This Web site describes how economists value the beneficial ways that ecosystems affect people. The site is designed for non-economists who need answers to questions about benefits of ecosystem conservation, preservation, or restoration. It provides a clear, non-technical explanation of ecosystem valuation concepts, methods, and applications.

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### *Environmental Valuation and Cost Benefit News*

[www.cost-benefit.com](http://www.cost-benefit.com). This online news resource posts legal, academic, and regulatory developments pertaining to the valuation of environmental amenities and disamenities, such as clean air, trees, parks, congestion, and noise. All stories include actual cost, benefit, or damage estimates.

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### *EPA's National Center for Environmental Economics*

<http://yosemite.epa.gov/ee/epa/eed.nsf/pages/homepage>. NCEE analyzes relationships between the economy, environmental health, and environmental pollution control. The Center investigates economic benefits and costs; economic incentives; size, composition, and effects of the pollution control industry; and risk assessment data used in economic analyses. This site offers publications, information about job and grant opportunities, events, and links to other environmental economic information on the Web.

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### *NEMO Impervious Surfaces Web Page*

[http://nemo.uconn.edu/impervious\\_surfaces](http://nemo.uconn.edu/impervious_surfaces). This Nonpoint Education for Municipal Officials (NEMO) site provides resources and links pertaining to impervious surfaces. The site provides introductory and other educational material on impervious surfaces and offers techniques for measuring, estimating and mapping impervious surfaces. Land cover data is available for Connecticut.

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# Calendar

The calendar is prepared with the cooperation of our readers. If you would like a meeting or event posted, please e-mail [forshee.carol@epa.gov](mailto:forshee.carol@epa.gov).

For an updated events calendar, see [www.epa.gov/newsnotes/calendar.htm](http://www.epa.gov/newsnotes/calendar.htm).

## May 2005

- 9-11 *RIVERMorph Software Training*, Carolina Beach, North Carolina. For more information see [www.rivermorph.com/training](http://www.rivermorph.com/training).
- 9-13 *EPA's Water Quality Standards Academy*, Washington, DC. For more information, see [www.glec-online.com/form.htm](http://www.glec-online.com/form.htm).
- 11 *Introduction to the Safe Drinking Water Act – Web conference* (for federal and state drinking water staff). For more information, contact the Drinking Water Academy at [dwaweb.conference@epa.gov](mailto:dwaweb.conference@epa.gov).
- 11-13 *Tribal Nonpoint Source Program Workshop*, Palm Springs, CA. For more information, call Stacie Craddock at 202-566-1204 or e-mail [craddock.stacie@epa.gov](mailto:craddock.stacie@epa.gov).
- 16-18 *2005 EPA Science Forum: Collaborative Science for Environmental Solutions*, Washington, DC. For more information, see [www.epa.gov/ord/scienceforum](http://www.epa.gov/ord/scienceforum).
- 17-18 *Getting in Step with Phase II: A Workshop for Stormwater Program Managers*, Memphis, TN. For more information, visit [www.epa.gov/npdes/gettinginstepwithphase2](http://www.epa.gov/npdes/gettinginstepwithphase2).
- 24-26 *New England Interstate Water Pollution Control Commission's 16th Annual Nonpoint Source Pollution Conference*, Bretton Woods, New Hampshire. For more information see [www.neiwppcc.org/npsannualmeeting.htm](http://www.neiwppcc.org/npsannualmeeting.htm).

## June 2005

- 5-10 *The South Atlantic Chapter of the Society of Wetland Scientists' 26th Annual International Wetlands Meeting*, Charleston, SC. For more information, see: [www.sws.org/charleston2005](http://www.sws.org/charleston2005).
- 8-10 *Susquehanna River Basin Commission's 2005 Riverfront Symposium*, Harrisburg, PA. For more information, see <http://srbc.net/RiverfrontSymposium.htm>.
- 11-17 *Association of State Floodplain Managers' 2005 Annual Conference*, Madison, Wisconsin. For more information, see [www.floods.org](http://www.floods.org).
- 12-15 *Ninth North American Agroforestry Conference: "Moving Agroforestry into the Mainstream,"* Rochester, Minnesota. For more information, see <http://cinram.umn.edu/afta2005>.
- 12-16 *American Water Works Association's 124th Annual Conference and Exposition*, San Francisco, CA. For more information, see [www.awwa.org/ace2005](http://www.awwa.org/ace2005).
- 27-29 *Institutions for Sustainable Watershed Management: Reconciling Physical and Management Ecology*, Honolulu, HI. For more information, see [www.awra.org/meetings/Hawaii2005](http://www.awra.org/meetings/Hawaii2005).

## July 2005

- 9-11 *Managing Watersheds for Human and Natural Impacts: Engineering, Ecological, and Economic Challenges*, Williamsburg, VA. For more information, see [www.asce.org/conferences/watershedmanagement2005](http://www.asce.org/conferences/watershedmanagement2005).
- 12-14 *River and Lake Restoration - Changing Landscapes*, Portland, Maine. For more information, see [www.ucowr.siu.edu/05CoP.pdf](http://www.ucowr.siu.edu/05CoP.pdf).
- 31 *Watershed Planning: Blueprint for Action!* (Part of the Soil and Water Society's Annual Conference in Rochester, NY). For more information, see [www.swcs.org](http://www.swcs.org).

## August 2005

- 3-4 *Getting in Step with Phase II: A Workshop for Stormwater Program Managers*, Indianapolis, IN. For more information, visit [www.epa.gov/npdes/gettinginstepwithphase2](http://www.epa.gov/npdes/gettinginstepwithphase2).

### Contribute to Nonpoint Source News-Notes

Do you have an article or idea to share? Want to ask a question or need more information? Please contact NPS News-Notes, c/o Carol Forshee, by mail at U.S. EPA, Mail Code 4503-T, 1200 Pennsylvania Ave., NW, Washington, DC 20460, by phone at 202-566-1208, or by e-mail at [forshee.carol@epa.gov](mailto:forshee.carol@epa.gov).

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