

# NWQEP NOTES

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NC STATE UNIVERSITY

## PROJECT SPOTLIGHT

### Invasive Exotic Vegetation – An Important Consideration of Ecological Restoration Projects

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#### Introduction

All of the experts have been assembled: the engineers, the hydrologists, the biologists, and maybe even a local official or two. The restoration plans have been drawn to perfection, the native plant species have been carefully selected, and the cattle-exclusion fences are at hand. Water quality will be restored to the small, bovine-trodden stream running through the manure-laden cow pasture. The finished product will be picture perfect. Hark, what looms in the distance that will tarnish such an image of beauty? No, could it be? Alas, it's the dreaded kudzu vine.

It is well known that ecological restoration rarely goes according to plan, despite best efforts. In many cases, particularly those of stream and riparian corridor restoration, it is a trial and error process. In North Carolina as well as other states in the U.S., there has been a trend towards restoring degraded streams using natural channel design, i.e., emulating a naturally occurring, non-disturbed stream, and revegetating the adjacent riparian corridor with native plants. Until recently, however, restorationists had not given much thought about the potential damage that non-native invasive plants could do to newly restored stream and riparian projects. At best, some exotic plants can be just an aesthetic annoyance on a newly restored project. At worst, these unwelcome plants can cause project failure. This article will briefly describe what invasive exotic plants are and why they are not welcome in native ecosystems. Case studies of exotic plant man-

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agement on stream and riparian restored sites in North Carolina will be presented at the end.

Over millions of years, natural forces have created complex ecosystems throughout the world. In theory, these systems are carefully balanced with animals, plants, and other organisms depending on each other to sustain themselves. Natural forces such as wind, rain, fire, and other geological, biological, and hydrological impacts have influenced the distribution of both flora and fauna. So basically, every organism naturally belongs to its own ecosystem home and is considered a native to that system. Once those species are transported out of their own system into another, they are then considered non-native within that new area. Non-native invasive plants can be defined as plant species that artificially occur outside of their natural ranges and display rapid and uncontrolled growth in new ecosystems. Non-na-

tive can refer to species transported from other countries, continents, regions, or even habitats within their own region. Not all non-native plants are bad. Examples of beneficial non-native plants in the United States include wheat, oats, and other grains important for food production. Plants such as these pose no real threat to the natural ecosystems in which they inhabit. However, there are many exotic plants transported around the world that are endangering natural systems.

A common question is how do these alien invasives harm native ecosystems. The nature of the invasive plant is to grow rapidly and spread quickly over a new area. In its home ecosystem, the exotic plant is kept in check by natural controls such as herbivores, diseases, and parasites. In a new area, the plant is free from these controls and can proliferate rapidly. Often, the exotic plant exhibits strong vegetative growth, abundant seed production, and short maturation periods. Many exotics can reproduce both sexually and vegetatively, giving them a further advantage over native species. Through these mechanisms, invasive alien plants can spread quickly through new ecosystems and overwhelm existing native flora. They will often form dense monocultures or single-species stands of vegetation. These dense stands often allow no other species to grow due to competition for rooting space, nutrients, and light. In some cases, these non-native aggressors alter hydrological patterns, soil chemistry, moisture-holding capacity, and soil erodibility (Randall and Marinelli, 1996). Some are harmful to native fauna. For example, garlic mustard (*Alliaria petiolata*), a plant that has naturalized alluvial areas and old fields of the eastern U.S., has been found to contain chemicals that will kill some native butterfly species. Animals and insects co-evolve with native plants and often depend on them for food. When non-native plants outcompete and replace native plants, this adversely affects the food source for native fauna.

More than 1,000 species of exotic plants have been identified as a threat to natural ecosystems in the United States (Swearingen, 2002). Many of these can be found in riparian and wetland areas throughout the southeastern part of the country. For restorationists, these plants can mean trouble for newly planted desirable native vegetation. In North Carolina, some examples (see Figure 1) of troublesome exotic species found in terrestrial areas along stream corridors include: Kudzu (*Pueraria lobata*), English ivy (*Hedera helix*), Oriental bittersweet (*Celastrus orbiculatus*), Chinese privet (*Ligustrum sinense*), silverberry (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and microstegium (*Microstegium vimineum*). Below is a descrip-

## EDITOR'S NOTE

The problem of exotic species invasion of native ecosystems has received a growing amount of attention in recent years. Ecological restorationists are often faced with the arduous task of eradicating invasive exotic vegetation before replanting with desired native species. In addition, long-term maintenance of exotics after restoration remains a challenge. This issue of *NWQEP NOTES* discusses the menace posed by invasive exotic vegetation and presents methods of control for two common species in the eastern United States: kudzu and multiflora rose. Case studies of stream and riparian restoration projects that have addressed exotics removal are also presented.

As always, please feel free to contact me regarding your ideas, suggestions, and possible contributions to this newsletter.

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tion of two of these plants in detail. The following species profiles are excerpts from the National Park Service's Plant Conservation Alliance fact sheets (Bergmann and Swearingen, 1997). More information can be obtained from their website at <http://www.nps.gov/plants/alien>.



Figure 1: Streamside infestation of kudzu (foreground) and multiflora rose in central, North Carolina.

## Kudzu

*Pueraria montana var. lobata* (Willd.) Maesen & S. Almeida

**Native range:** Asia

**Description:** Kudzu is a climbing, semi-woody, perennial vine in the pea family. Deciduous leaves are alternate and compound, with three broad leaflets up to 4 inches across. Leaflets may be entire or deeply 2-3 lobed with hairy margins. Individual flowers, about 1/2 inch long, are purple, highly fragrant and borne in long hanging clusters. Flowering occurs in late summer and is soon followed by production of brown, hairy, flattened, seed pods, each of which contains three to ten hard seeds.

**Ecological threat:** Kudzu kills or degrades other plants by smothering them under a solid blanket of leaves, by girdling woody stems and tree trunks, and by breaking branches or uprooting entire trees and shrubs through the sheer force of its weight. Once established, Kudzu plants grow rapidly, extending as much as 60 feet per season at a rate of about one foot per day. This vigorous vine may extend 32-100 feet in length, with stems 1/2-4 inches in diameter. Kudzu roots are fleshy, with massive tap roots 7 inches or more in diameter, 6 feet or more in length, and weighing as much as 400 pounds. As many as thirty vines may grow from a single root crown.

**Methods of reproduction & spread:** The spread of kudzu in the U.S. is currently limited to vegetative expansion by runners and rhizomes and by vines that root at the nodes to form new plants. Kudzu also spreads somewhat through seeds, which are contained in pods, and which mature in the fall. However, only one or two viable seeds are produced per cluster of pods and these hard-coated seeds may not germinate for several years.

**Background:** Kudzu was introduced into the U.S. in 1876 at the Philadelphia Centennial Exposition, where it was promoted as a forage crop and an ornamental plant. From 1935 to the mid-1950s, farmers in the south were encouraged to plant kudzu to reduce soil erosion, and Franklin D. Roosevelt's Civilian Conservation Corps planted it widely for many years. Kudzu was recognized as a pest weed by the U.S. Department of Agriculture and, in 1953, was removed from its list of permissible cover plants.

**Current management approaches:** For successful long-term control of kudzu, the extensive root system must be destroyed. Any remaining root crowns can lead to reinfestation of an area. Mechanical methods involve cutting vines just above ground level and destroying all cut material. Close mowing every month for two growing seasons or repeated cultivation may be effective. Cut kudzu can be fed to livestock, burned or enclosed in plastic bags and sent to a landfill. If conducted in the spring, cutting must be repeated as regrowth appears to exhaust the plant's stored carbohydrate reserves. Late season cutting should be followed up with immediate application of a systemic herbicide (e.g., glyphosate) to cut stems, to encourage transport of the herbicide into the root system. Repeated applications of several soil-active herbicides have been used effectively on large infestations in forestry situations. Efforts are being organized by the U.S. Forest Service to begin a search for biological control agents for kudzu.

## Multiflora Rose

*Rosa multiflora* Thunb.

**Native range:** Japan, Korea, and eastern China

**Description:** Multiflora rose is a thorny, perennial shrub with arching stems (canes), and leaves divided into five to eleven sharply toothed leaflets. The base of each leaf stalk bears a pair of fringed bracts. Beginning in May or June, clusters of showy, fragrant, white to pink flowers appear, each about an inch across. Small bright red fruits, or rose hips, develop during the summer, becoming leathery, and remain on the plant through the winter.



**Ecological threat:** Multiflora rose is extremely prolific and can form impenetrable thickets that exclude native plant species. This exotic rose readily invades open woodlands, forest edges, successional fields, savannas and prairies that have been subjected to land disturbance.

**Background:** Multiflora rose was introduced to the East Coast from Japan in 1866 as rootstock for ornamental roses. Beginning in the 1930s, the U.S. Soil Conservation Service promoted it for use in erosion control and as “living fences” to confine livestock. State conservation departments soon discovered value in multiflora rose as wildlife cover for pheasant, bobwhite quail, and cottontail rabbit and as food for songbirds and encouraged its use by distributing rooted cuttings to landowners free of charge. More recently, multiflora rose has been planted in highway median strips to serve as crash barriers and to reduce automobile headlight glare. Its tenacious and unstoppable growth habit was eventually recognized as a problem on pastures and unplowed lands, where it disrupted cattle grazing. For these reasons, multiflora rose is classified as a noxious weed in several states, including Iowa, Ohio, West Virginia, and New Jersey.

**Methods of reproduction & dispersal:** Multiflora rose reproduces by seed and by forming new plants that root from the tips of arching canes that contact the ground. Fruits are readily sought after by birds which are the primary dispersers of its seed. It has been estimated that an average multiflora rose plant may produce a million seeds per year, which may remain viable in the soil for up to twenty years. Germination of multiflora rose seeds is enhanced by passing through the digestive tract of birds.

**Current management approaches:** Mechanical and chemical methods are currently the most widely used methods for managing multiflora rose. Frequent, repeated cutting or mowing at the rate of three to six times per growing season, for two to four years, has been shown to be effective in achieving high mortality of multiflora rose. In high quality natural communities, cutting of individual plants is preferred to site mowing to minimize habitat disturbance. Various herbicides have been used successfully in controlling multiflora rose but, because of the long-lived stores of seed in the soil, follow-up treatments are likely to be necessary. Application of systemic herbicides (e.g., glyphosate) to freshly cut stumps or to regrowth may be the most effective methods, especially if conducted late in the growing season. Plant growth regulators have been used to control the spread of multiflora rose by preventing fruit set.

Biological control is not yet available for management of multiflora rose. However, researchers are investigating several options, including a native viral pathogen (rose-rosette disease), which is spread by a tiny native mite, and a seed-

infesting wasp, the European rose chalcid. Rose-rosette disease, native to the western U.S., has been spreading eastwardly at a slow pace and is thought to hold the potential for eliminating multiflora rose in areas where it grows in dense patches. An important drawback to both the rose rosette fungus and the European rose chalcid is their potential impact to other rose species and cultivars.

## Case Studies

### *Stone Mountain State Park*

#### *Alleghany and Wilkes Counties, North Carolina*

The East Prong Roaring River in Stone Mountain State Park is a 10,000 linear foot stream restoration project in western North Carolina (see *NWQEP NOTES* # 99), directed by the NC Stream Restoration Institute (SRI) at NC State University, that includes approximately 13 acres of riparian corridor restoration. The project was funded through a grant from the North Carolina Wetlands Restoration Program. The stream portion was completed in Fall 2000 while the riparian restoration is still currently ongoing. The ecosystem of this riparian area is typical of many southeastern bottomlands and includes species such as tulip poplar (*Liriodendron tulipifera*), river birch (*Betula nigra*), sycamore (*Platanus occidentalis*), spicebush (*Lindera benzoin*), tag alder (*Alnus serrulata*), sedges (*Carex* spp.), rushes (*Juncus* spp.), and others. Prior to restoration, a kudzu infestation was discovered in the lower portion of the project during initial surveying (see Figure 2). It was estimated that approximately four acres were affected by the kudzu, with many of the sycamores and shrubs smothered by the spreading vine. Before any native species were planted as part of the restoration work, the exotic vegetation problem was addressed. SRI contracted with a local firm specializing in exotic plant removal to cut and treat the vines. In July 2000, chainsaws were used to cut the vines at the base, after which



Figure 2: Kudzu at Stone Mountain State Park, NC, prior to eradication using physical and chemical methods.

a site-appropriate herbicide was applied directly to the cut stumps (see Figures 3 and 4). This process took approximately two days. No foliar spraying occurred, therefore, there was no concern about damaging native flora. Since the initial treatment, the area was surveyed each growing season to locate new sprouts. Although the initial treatment killed a majority of the plant, low-growing sprouts have been found during the last two growing seasons. When sprouts are discovered, their leaves are carefully sprayed with site-appropriate herbicide so as not to affect the surrounding vegetation. It was noted that some of the sycamore trees that were once covered with the vine have since sprouted new limbs and leafed out nicely during the first growing season after treatment. Maintenance will continue for at least the next three years. By monitoring this invasive exotic plant and treating it accordingly, the native trees and shrubs planted in December 2002 will have a better chance at survival on this restoration site.

*Brushy Fork  
Surry County, North Carolina*

The Brushy Fork project in western North Carolina is another stream restoration project directed by SRI that includes restoration of approximately 1600 linear feet of stream and about 2 acres of riparian corridor revegetation. Both stream restoration and replanting of native species were completed in February 2001. The native plants and ecosystem of this area are similar to that of Stone Mountain State Park, however, kudzu was not present at this site. Rather, the Brushy Fork site had a severe infestation of multiflora rose. The invasive and prickly pest completely dominated vegetation on both banks of the stream. Prior to construction of the new stream channel, the same local company specializing in exotic plant removal was contracted to initially cut and treat multiflora rose using a combination of cutting the plant at the base, and applying site-appropriate herbicide to both the base and directly to the leaves. Since most native vegetation was dormant during this time period (February), the leaf application of herbicide was not detrimental to the surrounding vegetation. It was, however, effective at killing multiflora rose, as the plant is somewhat evergreen and photosynthesizes during the winter.

Because the invasive plant covered a more extensive range on the project site than the budget allowed for, it was agreed that the project grant would fund treatment of a fifty-foot buffer on each side of the stream, while the landowner would maintain the outlying areas with mowing. The initial treatment was effective in killing much of the rose along the stream, however, new seedlings were recently discovered on the bank, most likely due to an abundant seed source upstream from the project site. Therefore, for project success, the area should be surveyed annually for resprouts and treated accordingly until the upstream problem is addressed. The challenge lies in the fact that since the grant project has officially ended, the responsibility of weed maintenance is now left with the landowner who potentially may be faced with financial and time constraints.

For More Information

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Figure 3: Cutting of kudzu vines at the base with chainsaws, prior to herbicide application.



Figure 4: Application of herbicide to freshly cut kudzu stump.

Additional information about invasive non-native plants can be found at the following web sites:

- <http://www.vnps.org/invasive.html>
- <http://www.nps.gov/plants/alien/>
- <http://www.invasive.org/>
- <http://www.invasivespecies.gov/>
- <http://www.invasiveplantcontrol.com/>

## References

Bergmann, C. and J. Swearingen 1997. Kudzu factsheet. Plant Conservation Alliance, Alien Plant Working Group. <http://www.nps.gov/plants/alien/fact/pulo1.htm>

Bergmann, C. and J. Swearingen 1997. Multiflora rose factsheet. Plant Conservation Alliance, Alien Plant Working Group. <http://www.nps.gov/plants/alien/fact/romu1.htm>

Randall, J. and J. Marinelli. 1996. Invasive plants: weeds of the global garden. Brooklyn Botanic Garden Club, Inc. Handbook No. 149. 111 pp.

Swearingen, J. 2002. Alien Plant Invaders of Natural Areas- List of Fact Sheets. <http://www.nps.gov/plants/alien/list/a.htm>



## Information

### 2002 Summary Report of Section 319 National Monitoring Program Projects

The annual report of the Section 319 National Nonpoint Source Monitoring Program (NMP) is available on-line at <http://h2osparc.wq.ncsu.edu/319index.html>. This report provides profiles for 24 watershed projects selected under the NMP that are being monitored over a 6- to 10-year period to evaluate effectiveness of best management practices in reducing nonpoint source water pollution.

### Proceedings from 8<sup>th</sup> National Nonpoint Source Monitoring Workshop

Proceedings from the 8<sup>th</sup> National Nonpoint Source Monitoring Workshop *Monitoring and Modeling Nonpoint Source Pollution in the Rural-Urban Interface*, held September 11-14, 2000 in Hartford, CT are available. Contact John C. Clausen, Department of Natural Resources Man-

agement and Engineering, University of Connecticut, 1376 Storrs Rd., U-4087, Storrs, CT 06269-4087, 860-486-0139 (voice), 860-486-5408 (fax), [jclausen@canr.uconn.edu](mailto:jclausen@canr.uconn.edu).

## Educational Materials Available from EPA

As part of USEPA's National Water Program's year-long celebration of the 30<sup>th</sup> Anniversary of the Clean Water Act, EPA is distributing educational materials for EPA's Wastewater Month (February 2003), Nonpoint Source Month (March 2003) and Storm Water Month (April 2003). Target audiences for these materials include municipal government officials and the general public. The materials are available to the public by mail and on the USEPA web site: [www.epa.gov/water/yearofcleanwater/month.html](http://www.epa.gov/water/yearofcleanwater/month.html).

The *Wastewater Month* public education kit for municipalities will include:

- Homeowner's guide to septic systems with companion fact sheet
- Septic system information sticker
- Homeowner's guide to central sewer systems
- Magnet
- Water bill insert that includes centralized and decentralized information
- Centralized poster — USGS
- Wastewater Treatment Programs Serving Small Communities
- SRF factsheet
- Wastewater Security brochure
- Press release for local newspaper

The *Nonpoint Source Month* public education kit will include:

- Nonpoint source pollution brochure
- Nonpoint source pollution poster
- Urban nonpoint source pollution fact sheet
- Agricultural nonpoint source pollution fact sheet
- Pop-up sponges with nonpoint source pollution message
- Magnet
- Polluted runoff crossword puzzle placemat

The *Storm Water Month* public education kit will include:

- General Storm Water Awareness brochure

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- Homeowner Guide (car washing, vehicle fluids changing, lawn & garden care, pet waste, septic system management)
- Small Construction Guide poster
- Press release on storm water issues relevant to the public
- Public service announcement off the radio
- Washington Post delivery bag (“Scoop the poop”)
- Stickers
- Door hanger with illicit discharge message
- PowerPoint presentation for municipal officials to give to the public

## A Guide to Understanding a Sense of Place from EPA

The USEPA’s *Community Culture and the Environment: A Guide to Understanding a Sense of Place* is available for ordering. The Guide explores the concepts of community and culture and provides tools for identifying, assessing, and working cooperatively within the social dynamics and local values connected to environmental protection. These tools will help you define your community, identify stakeholders, enhance education and outreach, build partnerships and consensus, identify resources, plan and set goals, and integrate local realities with ecological issues. The Guide is designed for people involved in community-based initiatives, including those affiliated with community and watershed-based organizations, universities, and federal, state, tribal, and local agencies. Learn more about this resource by visiting <http://www.epa.gov/ecocommunity/tools/community.pdf>.

## Farm & Home Environmental Management Programs Newsletter

The Fall Issue of the Farm & Home Environmental Management Programs Newsletter has been posted on the University of Wisconsin – Extension website. Produced by the staff of the National Farm\*Home\*System office, the newsletter aims to inform interested readers about voluntary pollution prevention programs around the nation and about new research and policy impacting the management of environmental risk on farms and in homes. The newsletter can be viewed at: <http://www.uwex.edu/farmasyst/>.

## Papers Available on TMDL Conference

103 papers are now available from the Water Environment Federation’s (WEF’s) National TMDL Science and Policy 2002 Specialty Conference, held in Nov. 2002 in Phoenix, AZ. Visit WEF’s web site for more information at: <http://www.wef.org/>.

## Green Up Your Lawns Brochure Now Available On-Line

The pdf for *Green Up Your Lawns - Not Your Lakes and Rivers* brochure can now be viewed on the web, along with information on how it can be obtained and used: <http://www.bwsr.state.mn.us/outreach/education/index.html>.

This is the general public information brochure developed by cities in the Twin Cities, MN, metro area that speaks about using no phosphorus lawn fertilizer and keeping leaves, grass clippings and pet waste from going down storm drains. It is available as a Quark publishing file on CD for \$15 shipping and handling. ■

## Meetings

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### Call For Papers

**NALMS 2003: Annual Symposium of the North American Lake Management Society: Protecting Our Lakes’ Legacy: November 5-8, 2003, Mashantucket, CT.** Visit NALMS web site at: <http://www.nalms.org> for more information. **Abstracts due April 30, 2003.**

**TMDL 2003: November 16-18, 2003, Chicago, Illinois.** Abstracts are invited on the following topics: Water Quality Standards; Monitoring and Listing Methodologies; Modeling; Wet Weather and NPS Loads and Controls; TMDL Development and Implementation; Regulatory, Policy, and Funding Issues; State and Tribal Programs; Stakeholder Involvement and Public Participation. For more information visit: <http://www.wef.org/pdf/files/TMDL03Call.pdf>. **Abstracts due March 28, 2003.**

**Second Conference on Watershed Management To Meet Emerging TMDL Environmental Regulations: November 8-12, 2003, Albuquerque, NM.** Contact Barbara Sowden, ASAE, 2950 Niles Road, St. Joseph, Michigan 49085. Tel: 269-428-6327; Fax: 269-429-3852; Email: [sowden@asae.org](mailto:sowden@asae.org). **Abstracts due March 31, 2003.**

**WATERSHED 2004: July 11-14, 2004, Dearborn, Michigan.** Abstracts are invited on the following topics: Program Development; Assessment and Modeling; Restoration and Protection; and Regional Topics. For more information, visit web site: <http://www.wef.org/pdffiles/Watershed04Call.pdf>. **Abstracts due August 1, 2003.**

## Meeting Announcements — 2003

### February

**Urban Stormwater: Enhancing Programs at the Local Level: February 17-20, 2003, Chicago, Illinois.** Contact conference coordinator Bob Kirschner, Chicago Botanic Garden, 1000 Lake Cook Road, Glencoe, Illinois, 60022; email: [bkirschn@chicagobotanic.org](mailto:bkirschn@chicagobotanic.org).

**International Erosion Control Association 34<sup>th</sup> Annual Conference and Expo: February 24-28, 2003, Las Vegas, Nevada.** Tel: 970-879-3010; Fax: 970-879-8563; Web site: [www.ieca.org](http://www.ieca.org).

### April

**Illinois Lake Management Association 18th Annual Conference: April 3-5, 2003, Bloomington, Illinois.** Contact Dick Hilton at [Wildick@mc.net](mailto:Wildick@mc.net); Tel: 800-338-6976 access code 01.

**Restore America's Estuaries Inaugural National Conference on Coastal and Estuarine Habitat Restoration: April 13-16, 2003, Baltimore, MD.** Contact Heather Bradley, Conference Coordinator, at 703-524-0248, or [hbradley@estuaries.org](mailto:hbradley@estuaries.org). Web site <http://www.estuaries.org/>

**16th Annual National Conference: Enhancing The States' Lake Management Programs / Developing and Implementing TMDLs for Lakes and Reservoirs: April 22-25, 2003, Chicago, Illinois.** Contact: Bob Kirschner, Chicago Botanic Garden, 1000 Lake Cook Road, Glencoe, Ill., 60022. Email: [bkirschn@chicagobotanic.org](mailto:bkirschn@chicagobotanic.org); Web site: <http://www.nalms.org/symposia/chicago/index.htm>.

**6th National Mitigation Banking Conference: Practice and Policy: April 23-25, 2003, San Diego, CA.** Web site: <http://www.mitigationbankingconference.com>, or contact Carlene Bahler at [cbahler@erols.com](mailto:cbahler@erols.com) or 703-548-5473.

### May

**American Wetlands Conference: May 1-4, 2003, Minneapolis, MN.** Izaak Walton League of America, American Wetlands Campaign. Tel: 800-BUG-IWLA, Fax: 301-548-0146; Email: [awm@iwla.org](mailto:awm@iwla.org); Web site: [www.iwla.org/sos/awm](http://www.iwla.org/sos/awm).

**The American Water Resources Association Agricultural Hydrology Technical Committee 2003 Spring Specialty Conference: Agricultural Hydrology and Water Quality: May 11-14, 2003, Kansas City, Missouri.** Contact Harriette Bayse at [harriette@awra.org](mailto:harriette@awra.org); Web site: [www.awra.org/meetings/Kansas2003/](http://www.awra.org/meetings/Kansas2003/).

**Delineation of Piedmont and Coastal Plain Jurisdictional Wetlands: May 19-23, 2003, Raleigh and New Bern, NC.** Contact Becky Bowers at 919-515-9563, [becky\\_bowers@ncsu.edu](mailto:becky_bowers@ncsu.edu), or for more information visit web site: [www.ncsu.edu/feop](http://www.ncsu.edu/feop).

### June

**Society of Wetland Scientists 24<sup>th</sup> Annual Meeting: Wetland Stewardship: Changing Landscapes and Interdisciplinary Challenges: June 8-13, 2003, New Orleans, LA.** Contact the Program Committee Co-chairs Doug Meffert ([dmeffert@tulane.edu](mailto:dmeffert@tulane.edu)) or Robert Twilley ([ceet@louisiana.edu](mailto:ceet@louisiana.edu)). Web site: <http://www.sws.org/neworleans/>.

**Environmental Statistics Short Course: June 16-18, 2003. Colorado State University, Fort Collins, Colorado.** For information contact Jim Loftis, [loftis@engr.colostate.edu](mailto:loftis@engr.colostate.edu).

**The Fourth National Workshop on Constructed Wetlands/BMPs for Nutrient Reduction and Coastal Water Protection: June 23-25, 2003, Wilmington, North Carolina.** Contact Dr. Frank Humenik, Waste Management Programs, College of Agriculture and Life Sciences, Campus Box 7927, North Carolina State University, Raleigh, NC 27695-7927. Tel: 919-515-6767; Fax: 919-513-1023; Email: [frank\\_humenik@ncsu.edu](mailto:frank_humenik@ncsu.edu).

**AWRA's 2003 International Congress: Watershed Management for Water Supply Systems: June 29-July 2, 2003, New York City, NY.** Contact Peter E. Black, International Congress Organizing Chair, SUNYESF, 1 Forestry Drive, Syracuse, NY 13210. Tel: 315-470-6571; Fax: 315-470-6956; Email: [pebchair@esf.edu](mailto:pebchair@esf.edu); web site: [www.awra.org](http://www.awra.org).

## 11th National Nonpoint Source Monitoring Workshop

September 7-11, 2003  
Southeast Michigan

<http://www.ctic.purdue.edu/CTIC/NPSCall.html>

**About the Conference:** The 11<sup>th</sup> year of this workshop will once again bring together land managers and water quality specialists to share information on the effectiveness of best management practices in improving water quality, effective monitoring techniques, and statistical analysis of watershed data. The workshop will focus on the successes of Section 319 National Monitoring Program projects as well as other innovative monitoring projects from throughout the U.S. The agenda will include three days of workshop sessions/presentations and a one-day field trip to visit nonpoint source project sites relating to the workshop.

### Session Topics:

- Urban Stream Restoration
- NPS Modeling
- BMP Tracking and Monitoring Techniques
- Low Impact Development Approaches
- Stream Buffers

Presentations will be 20 minutes long, plus 10 minutes for discussion. Poster presentations are also encouraged. All presenters will submit a brief paper due one month before the conference. Abstracts for committee review are limited to one page, single-spaced or 300 words. Submission via email is encouraged. Preferred format is MS Word. Please include your name, affiliation, mailing address, email address, telephone/fax numbers, session topic and presentation type — oral or poster. Authors will be notified by May 3, 2002 regarding the status of their abstract.

**Deadline for abstract submission — April 4, 2003**

Nonpoint source workshop web site:  
[www.ctic.purdue.edu/NPSWorkshop.html](http://www.ctic.purdue.edu/NPSWorkshop.html)

Mail disk and hardcopy to:  
Nonpoint Source Workshop  
1220 Potter Drive, Suite 170  
West Lafayette, IN 47906  
Phone: 765-494-9555; Fax: 765-494-5969

Contact Tammy Taylor at [taylor@ctic.purdue.edu](mailto:taylor@ctic.purdue.edu) or call 765-494-9555.

## July

**Soil and Water Conservation Society 2003 Annual Conference: July 26-30, 2003, Spokane, Washington.** Web site: <http://www.swcs.org>.

**StormCon '03: The North American Surface Water Quality Conference & Exposition: July 28-31, 2003, San Antonio, Texas.** Web site: <http://www.stormcon.com>.

## September

**11th National Nonpoint Source Monitoring Workshop: September 7-11, 2003, Southeast Michigan.** Contact Tammy Taylor at [taylor@ctic.purdue.edu](mailto:taylor@ctic.purdue.edu) or call 765-494-9555. Web site: <http://www.ctic.purdue.edu/NPSWorkshop.html>. *See highlight at left.*

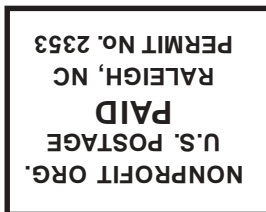
**Watershed Restoration Institute: September 22-26, 2003, Reisterstown, Maryland.** Hosted by the Center for Watershed Protection and River Network. Contact Jack Tawil or Stephanie Linebaugh at 410-461-8323, or Web site: <http://www.cwp.org>.

## October

**American Institute of Hydrology 2003 Annual Meeting and Conference: Achieving Sustainable Water Resources in Areas Experiencing Rapid Population Growth: October 19-22, 2003, Atlanta, Georgia.** Contact AIH at Tel: 615-484-8169; Fax: 651-484-8357; Email: [AIHydro@aol.com](mailto:AIHydro@aol.com); Web site: <http://www.aihydro.org/>.



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