Cacapon

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Education at Cacapon Institute

For over 23 years, CI's mission has remained rooted in the belief that an objective science program that works to understand issues of regional importance, coupled with an education program that helps the community better understand those issues, provides an important tool in protecting our environmental legacy.

In recent years, our work on Chesapeake Bay issues helped turn a number of standalone educational programs into an integrated whole. Underlying all is the understanding that restoring both our local waters and the Chesapeake Bay will require widespread changes in behavior by the private sector that will take time to accomplish. We have tailored our educational program to support societal change through school-based educational programs designed to foster a generation of environmentally literate citizens and environmental leaders.

Our education program focuses on five areas:

Anywhere in the World. Students on a barge in Thailand write to students at Capon Bridge Middle School, WV (Spring 2008). Their teacher used the eSchool for watershed lessons and teaching English. This led to a sister watershed relationship with Capon Bridge.

1. **The Potomac Highlands Watershed School (eSchool)** offers watershed educational content free-of-charge, 365/7/24 to anyone in the world with and internet access. Interactive lessons and activities teach water quality and watershed concepts and issues, disseminate information about sound land management, and provide a forum for students and teachers to discuss conservation issues. PHWS, a certified Chesapeake Bay Program Approved Teachers' Resource, enhances creative use of computers in regional schools, provides quality environmental education that is available on demand, and fits into required curricula. Lesson plans for teachers are included.

2. Internet based **Environmental Forums** provide intense and extended critical thinking/ problem solving exercises on topical environmental issues for high school students throughout the Chesapeake Bay watershed (story on page 3).

3. Our **Potomac Headwaters Leaders of Watersheds (PHLOW)** program provides an opportunity for students to become environmental leaders (page 12).

4. **Stream Scholars Summer Camp** provides middle and high school students an opportunity to test their talent for extended study of stream science (story on page 16).

5. **Outreach to community-based conservation organizations** aims to engage adults in substantive curriculum-based education programs using the eSchool lessons and hands-on activities that foster an educated generation of youth who are connected with their communities. Adult mentors help to ensure a sustained and growing core of youth volunteers learning to improve water quality, sustain habitat and living resources, and positively impact local watersheds. At the same time, participating organizations will become better educated themselves while increasing their visibility and effectiveness.

INSIDE

Education Vision

In 30 years, a stream without a buffer will be as out of place as a smoker in a conference room is today.

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Cacapon Institute
Is a nonprofit corporation founded in 1985.
Our mission: From the Cacapon to the Potomac to the Chesapeake Bay, we protect rivers and watersheds using science and education. dedicated to using science and education to help people protect and enjoy the Cacapon, Potomac and other Appalachian watersheds

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On Watersheds and Deer

- From the Director

Cacapon Institute is a watershed-based science and education organization. We study how land use and land cover impact water quality and quantity, we seek innovative solutions to watershed problems, and we offer related education programs. So, why would a watershed-focused organization like CI run an annual, month long, high school environmental forum on deer overpopulation (story page 3)? And why are we doing experiments on deer fencing (story page 5)?

Because overabundant deer are a watershed problem.

The Chesapeake Bay Program is planting 10,000 miles of forested riparian (streamside) buffers in the Chesapeake Bay watershed to protect the health of streams and downstream waters like the Chesapeake Bay from pollution. These forested buffers capture pollutants before they can reach streams, and it is important that these forested buffer plantings actually grow into riverside forests. But excessive deer browsing can cause riparian plantings to fail. And that makes deer a watershed problem.

But we think over abundant deer are a much bigger watershed problem than just destroying new riparian buffers. Forests are the gold standard for land cover in maintaining and ensuring clean water. Healthy forests store, clean and release most of the water that recharges groundwater levels and maintains stream flow. The health of a watershed depends largely on the health and extent of the forested lands.

What do I mean by "healthy forest?"

Forests can be divided into three layers: the canopy (top layer), the understory, and the forest floor. **The canopy** intercepts and slows rain, and provides habitat, protection, and shade for the animals and plants that live in the forest. **The understory** is the layer of smaller trees and shrubs below the canopy. The healthy **forest floor** is covered by a rich layer of decaying leaves and wood, populated by plants (such as grasses, herbs, mosses, tree seedlings) and animals (microorganisms, worms, insects, mammals). The litter on the forest floor is a storehouse of nutrients and organic material that also enriches and protects the underlying soil from erosion.

For a forest to be healthy, all three of these layers must be intact and functioning.

When white tail deer are too abundant, both the understory and the forest floor layers become degraded, sometimes severely. The understory becomes thin, with few or no new seedlings given a chance to grow, and few leaves left below the deer browse height. The accumulation of fallen leaves that forms much of the litter layer on the forest floor may also largely disappear, particularly on hillsides.

Where that happens, the role that a thick bed of decaying leaves and good forest soil structure play in slowing runoff, storing moisture, and cycling nutrients may be diminished as a result. This would, in turn, lead to drier hillsides, more erosive runoff, less infiltration, less groundwater recharge, drought stressed forests, and flashier streams that dry up easily. That is a watershed problem.

Thanks to a National Fish and Wildlife Foundation grant, CI is beginning a long-term study to determine if exclusion of deer from sections of forest leads, over time, to an increase in leaf litter retention, restoration of a healthy forest soil structure, and an increase in retained moisture. The same project is assessing the effectiveness of a new electric fence design in protecting riparian forest buffer plantings and upland forests. This project will measure the relative success of fenced and unfenced sites in riparian and upland forest settings, and identify strategic approaches to restoration plantings in areas of high deer density – as in much of the Chesapeake Bay watershed.

Environmental Forums

Forum (fo-rum) n. pl. -rums or -ra An assembly, meeting place, program, etc. for the discussion of questions of public interest.

The Potomac Highlands Watershed School's Environmental Forum (the eForum) provides a unique setting for high school students to undertake in-depth explorations of the science and societal challenges posed by regionally important environmental problems. Students work both as a class and with other students across the internet to understand problems affecting their communities. Then, working as stakeholders, they seek solutions that are broadly acceptable. High school classes throughout the Chesapeake Bay watershed are invited to take part in this no-cost activity.

The eForum is an example of **Project Based Learning (PBL)**, where students tackle a complex problem through a collaborative process over an extended period of time. PBLs are a core component of a 21st5 Century Education program, which is promoted by the WV school system.

When the eForum is coupled with hands-on conservation or research projects it provides a **Meaningful Watershed Educational Experience (MWEE)**, an expansive form of project based learning that is a curriculum requirement in MD, VA, PA, and D.C. Lesson plans and links to relevant educational standards are provided for teachers on the website at **www.cacaponinstitute.org/PBL.htm**.

CI has two eForums: Stream Cleaner (SCE Forum) and Oh Deer! **Each eForum has these distinct parts**:

Background Lessons. Students explore the science and societal dynamics of the subject in a guided course of lectures, readings, and web-based activities available year round.

Form Stakeholder Groups. Students roll play as farmers, homeowners, business owners, fishermen, etc. to draft Point of View position papers that are posted to

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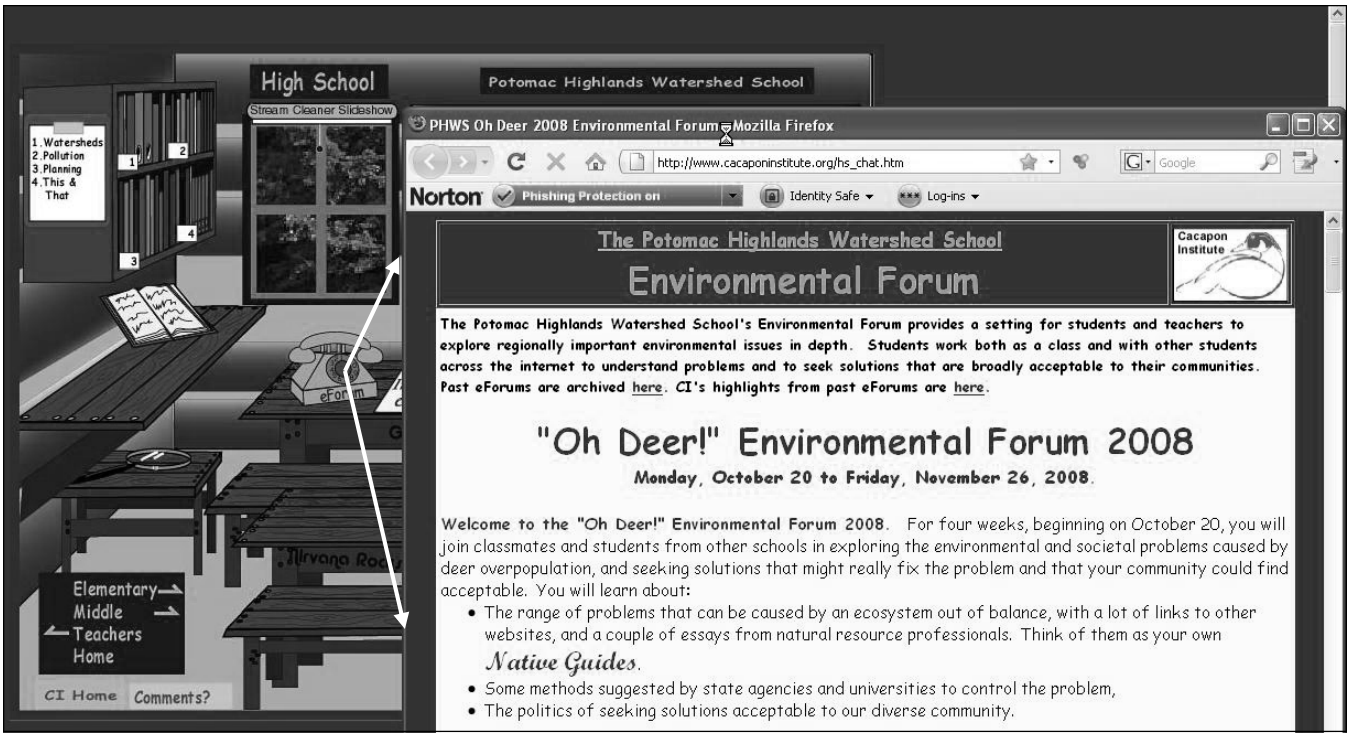
"I love the forums. They are teaching me to do what I wanted to but did not understand how. Now I do. . . . . With your forum the students need to come to a consensus for a large, real controversial topic twice - as a small group and as a large group. They get to see a BIG picture to a for-real BIG problem. Then they get to see what solution others propose. . . . It has also taught me a respect for the ability of many of my students to see the big picture and to express it concisely. I have been delighted all way round with your wonderful, usable concept of small to large and real problems for real learning."

Susan Settle, Rappahannock High School, Virginia



eForum *(Continued from page 3)*

the eForum webpage.

Interactive Dialogue. Stakeholder groups post Thoughtful Questions to other stakeholder groups in their own class and cross the web to support like-minded groups or challenge others in a moderated discussion,

Consensus. Classes regroup to define solutions that mitigate the environmental problem, are socially acceptable, and respect the needs of stakeholder groups.

"The Cacapon Institute is using technology to engage students about their watershed and the Chesapeake in new and exciting ways. CI's website and online forum, both showcased at our 2007 Chesapeake Bay Education Summit, are prime examples of how innovative technology can help us reach the goal of providing all students in the region with a Meaningful Watershed Educational Experience."

-Kevin Schabow,
NOAA Education Specialist

Oh Deer! eForum

Each autumn, students explore the environmental and societal problems caused by deer overpopulation **in our Oh Deer! eForum**. It's not a small problem; deer are one of the biggest threats to forest health in the Northeast, they cause many millions of dollars in damage to agricultural interests every year and deer-automobile collisions cost millions and cause immeasurable injury to people and deer alike. It's not a simple problem to solve either, with competing economic and societal interests on the many "sides" of this issue. The student's challenge is to seek solutions their community could find acceptable that might really fix the problem. They learn about:

- The range of problems that can be caused by overabundance of deer, with a lot of links to information on other websites, but starting with essays from "native guides" - natural resource professionals,
- Some methods suggested by state agencies and universities to control the problem,
- The challenge of seeking solutions, for a highly contentious issue, that might be acceptable to their diverse community.

"The students are learning a great deal about our watershed. Something that I hadn't counted on is that they are learning life lessons on how to deal with people of different ages and abilities."

This latest Oh Deer! eForum ended on November 26, 2008. More than 400 students, from 10 schools in Maryland, N. Carolina, Virginia, and West Virginia have taken part in the Oh Deer! eForum since it's inception in the fall of 2005.

SCE Forum -
Stream Cleaner Environmental Forum

Each spring, high school classes across the Chesapeake Bay watershed can participate in a regional dialogue about the Chesapeake Bay watershed's problems and propose their solutions to reduce non-point source pollution. Participating schools have a chance to receive support for an on-the-ground project at or near their schools.

Students learn about:

- The science that is used to understand the problems and monitor changes,
- The computer models that are used to understand the Bay's current condition and predict its future,
- The "best management practices" that are used to reduce the flow of pollution from our lands to local streams, larger rivers, and eventually, the Bay,
- The politics of seeking solutions acceptable to our diverse community, and
- The challenge of fostering widespread public acceptance and implementation of the entirely voluntary land use changes needed to protect our local waters and the Bay
- The challenge of paying for the cleanup.

Because of the large amount of information students need to absorb, we encourage teachers to incorporate SCE Forum content into their lessons well before the interactive part of the eForum begins. As the SCE Forum fits so well with concepts teachers are required to teach anyway, this is not difficult to do.

From Baltimore (MD) west to Petersburg (WV), from Richmond (VA) north to North Harford (MD) along the Susquehanna, more than 500 students, from 16 schools in three states have taken part in the SCE Forum since it's inception in the spring of 2006. The 4th Annual SCE

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Failure is Not an Option: Investigating a Cost-Effective Approach to Reducing Deer Damage in Reforestation Programs.

Forested riparian (riverside) buffers are wide strips of trees located along river and stream corridors. They provide many important benefits, including shade to keep river water cool and wildlife habitat. They also dramatically reduce the flow of pollution from the land into our rivers by filtering nutrients, sediments and other pollutants from runoff as well as removing nutrients from groundwater, allowing cleaner water to flow to the stream.

Thousands of miles of riparian trees are being planted across the Chesapeake Bay watershed to improve water quality and restore ecosystem functions in our rivers and streams. According to the Chesapeake Bay Program, between 1996 and 2005 tributary teams and other partners planted 4,606 miles of riparian forest buffers throughout the watershed. Through the Bay Program, D.C., Maryland, Pennsylvania, Virginia, and West Virginia have pledged to plant 10,000 miles of riparian buffers by 2010. (http://www.chesapeakebay.net/newsriparian121205.htm)

The considerable expense of riparian plantings (over $1000 per acre) is justified by the need for improving water quality and restored ecosystem functions. However, planting the trees is not enough. The planted trees must actually survive and grow if the goal of improving water quality is to be achieved.

Where deer are over-abundant, these plantings all too often fail. After documenting severe damage from deer browsing at two WV Potomac Tributary Strategy riparian demonstration plantings, Cacapon Institute (CI) decided to do something about it.

"This project began out of sheer frustration as much as anything," said Neil Gillies, CI's Director. "Cacapon Institute is monitoring three riparian forest planting sites for the WV Potomac Tributary Strategy Implementation Team. Two years after the planting, more than ninety percent of the trees at two of the three sites had been badly damaged by deer browsing, despite the fact that the trees were planted in tree tubes to prevent that problem. Most of the trees that grew to the top of their tube then suffer repeated browsing episodes that prevented them from growing any taller. And it is not the number of trees planted but the number of trees we grow that will restore our forests and protect our waters."

It is not the number of trees planted but the number of trees we grow that will restore our forests and protect our waters.

With a small grant from WVDEP, CI began a pilot study in the spring of 2007 to test a low cost, electric fence approach to excluding deer from tree plantings. Two riparian plantings test sites in areas with high deer density were selected.

Each study site has two control and two experimental subplots. Each test block is 100 feet long with a width of between 35 and 60 feet. The experimental subplots have a double or triple perimeter of single strand, solar charged power source, temporary electric fencing that surrounds the protected area. The wires are from 24" to 30" above the ground and the concentric rings of electric wire are between 4 and 8 feet apart.

Results from June 2007 through June 2008 were very encouraging, indicating that when the fence is properly installed and energized, protection within fenced areas was nearly 100%, while all the trees

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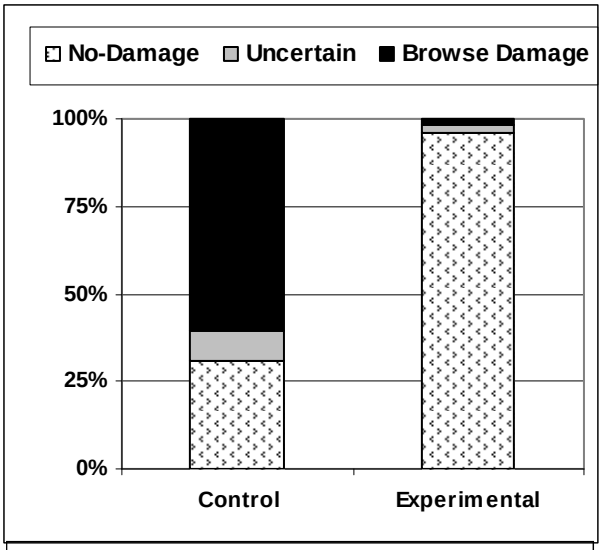
Deer Fence *(Continued from page 5)*
outside continued to be damaged by deer. The installed cost for the fence ($728) is slightly lower than the cost of tree tubes and stakes ($858) for an acre planting, with the cost: benefit ratio improving as the size of the planting area increases.



Comparison of "recent" browsing in control and experimental (fenced) subplots. Recent defined as stem near clip still green. 100% of plants in control areas were browsed at least once.

Here is a summary of what we saw in the first two years:

- In the first few weeks after installation, the fence must be inspected for damage as deer acclimate its presence.
- If the fence is properly installed, energized, and clear of heavy weed growth, protection within fenced areas is ~100%.
- Failure to maintain the fence reasonably clear of heavy weed growth results in lowered voltage on the fence and, over time, dramatically reduced success.

Browsed hazelnut in control area.

This year, CI received a $48,683 grant from the National Fish and Wildlife Foundation Chesapeake Bay Small Watershed Grants Program to continue this project and the U.S. Forest Service and state agencies are keenly watching the progress. The new, three-year funding will allow CI to expand the pilot experiment to protect 6,000 linear feet of riparian forest buffer plantings and two acres of upland forest. This project will measure the relative success of fenced and unfenced sites and identify strategic approaches to restoration plantings in areas of high deer density – as in much of the Potomac Highlands. The project seeks to provide valuable scientific data and outreach materials to NGOs and communities across the Chesapeake Bay watershed involved in riparian forest buffer plantings, with the goal to ensure that these

Un-browsed hazelnut in fenced area.

restoration investments achieve maximum pollutant reduction and habitat benefits.

The upland forest part of this project has two components: forest restoration and a study of forest hydrology. The restoration part will assess how well CI's fence design works at excluding deer in a

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Farmers as Producers of Clean Water: Providing Economic Incentives for Reducing Agricultural Non-point Pollution

The states in the Chesapeake Bay watershed - Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia - the District of Columbia, and the U.S. Environmental Protection Agency are working together to reduce the flow of nutrients (nitrogen and phosphorus) and sediment transported from each of the Bay States into the Bay. Each of the Bay states has established Tributary Teams to develop strategies for reducing nutrients and sediment, and to implement their strategies. The goal of reducing nutrient flow from the land to rivers and streams represents a long term commitment by the state of West Virginia.

Most of non-point sources of nutrients and sediment pollution in the Chesapeake Bay watershed is attributed to agricultural sources, and the efforts to reduce it are mostly voluntary conservation measures, called best management practices (BMPs). Government agencies provide technical support and financial assistance to farmers in the form of cost-share funding. The cost share percentage ranges from as low as 50% to as high as 90% paid by the government agency, with the balance paid in dollars or in-kind services by the farmer. Where established, these BMPs have proven effective at reducing the amount of pollution reaching our waterways. However, water quality problems remain, indicating a need for complimentary measures.

Cacapon Institute, in partnership with WVU economists Dr. Alan Collins and Peter Maille, received a USDA-National Research Initiatives grant to conduct a field experiment testing how performance-based economic incentives might be added to the mix of available conservation strategies. Specific objectives are:

1. Derive and assess a pricing formula based on water quantity and quality that provides an appropriate incentive for farmers to implement best management practices (BMPs) to conserve surface water resources;
2. Given the availability of incentive payments, assess changes in farmer attitudes and behavior towards BMPs that protect and conserve water resources relative to the traditional cost share approach;
3. Monitor changes in water quality and quantity in response to performance-based economic incentives and compare to monitoring in other watersheds where these incentives are not offered; and
4. Compare the cost effectiveness of water quality improvements for incentive payments relative to the traditional cost share approach.

In this experiment, incentive payments to participating farmers are keyed to water quality improvements as opposed to paying for the adoption of BMPs. In other words, payments are based on actual *results*, not *practices*. Economic incen-

Neil Gillies collects data from electronic stream gage on Cullers Run.

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Peter gets his Ph.D.

Peter Maille, one-time Education Director of Cacapon Institute, earned his Ph.D. in Natural Resource Economics at WVU with a dissertation based on the "Farmers as Producers of Clean Water" project.

Stream Scholars Summer Camp 2008

Counterclockwise, start top left: Stream Scholars collecting in stream; WVDEP's Tim Craddock leads lesson; water pennies on fingertips; camping at Point Lookout, MD; group picture on boat on Patuxent River; U. Md's Jackie Takacs demonstrates secchi disk; Scholars meet Senator Rockefeller in his office; Scholars at ceremonial tree planting with kindergarten students of Tyler Elementary School in DC. Story PAGE 16.

2008 Stream Cleaner Environmental Forum students from Buffalo Gap High School (Staunton, VA) did an erosion control project at Beverly Manor Elementary School in May 2008.

2008 Stream Cleaner Environmental Forum students from Jefferson High School (Jefferson Co., WV) plant trees at constructed wetland on campus. Spring 2008.

Potomac Headwaters Leaders of Watersheds (PHLOW) at East Hardy High School construct a stream table (spring 2008). Story Page 12.

STUDENT PROJECTS

Farmers as Producers . *(Continued from page 7)*

tives offer a chance to change farmer perspectives of water quality conservation from an operational constraint to an income opportunity. Another unusual aspect of the project is that we work with the participating farmers as a group instead of as individuals.

The project is located in the Cullers Run watershed at the head of the Lost/ Cacapon River watershed in Hardy County, WV. We chose Cullers Run for this project for a number of reasons:

Payments are based on actual water quality *results*, not *practices*.

- Water quality data has been collected since 1995, variously by the WV Department of Agriculture, Cacapon Institute, and the US Geological Survey.
- These data indicate that Cullers Run has relatively high levels of nitrate-nitrogen (N) for the area.
- CI studies found a notable, increasing nitrate gradient in the watershed and;
- It is a small watershed (9 square miles).

The above characteristics make Cullers a stream where there is a reasonably good chance of measuring a water quality effect due to changes in agricultural practices in a short time frame.

Water quality monitoring for this project is being conducted by Cacapon Institute under a subcontract with WVU. Sampling consists of regularly scheduled twice monthly samples, along with additional samples collected to gain a more detailed understanding of water quality patterns in the watershed. Water quality parameters include conductivity, pH, temperature, nitrate-N, total phosphorus, fecal coliform bacteria, and turbidity. We also take stream flow measurements at the time of sampling, and installed a water level sensor at the Cullers Run outlet for continuous recording of stream water levels.

In order to determine if the water in Cullers Run is changing, data are compared to water quality in a reference watershed: Waites Run. This 12.8 sq. mi. watershed near Wardensville is over 96% forested, lies within the region. Monitoring data indicates that its nitrate-N levels are quite low and respond very little to a wide range of rainfall regimes (Cacapon Institute 2002). Waites Run also has a USGS Flow Gage site.

The water quality focus of this project is nitrate-nitrogen. Nitrate, unlike the other pollutants we measure, moves into our streams both in runoff and through groundwater. It is a consistent indicator of the amount of fertilizer used on our lands. Nitrate is high in Cullers Run because it is a small watershed with a significant amount of row crop agriculture, which is unusual in this area. Nitrate "leaks" from cropland more easily than from other fertilized agricultural (or residential) lands. It's <u>not</u> high because the farmers there are doing a "bad" job.

Cullers Run farmers were recruited during a series of informational meetings held in Mathias, WV during the winter of 2007. Elements of successful recruitment included having sufficient water quality data to provide evidence of a problem, conducting informational meetings with immediate benefits to attendees, creating partnerships with local organizations and elites to build trust among farmers, assisting group decision making with an advisory committee, and development of clearly written contractual provisions with numerous review and feedback opportunities provided to farmers. During the first two years of the experiment (2007 and 2008), participation of about one-half of the farmers in the watershed has been achieved.

To effectively address agricultural non-point pollution in this experiment, farmers utilize a team approach based on voluntary participation in group interaction and decision-making. This approach provides increased flexibility to farmers in the selection of non-point source pollution mitigation measures that brings their concerns, and abilities, as commodity

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Farmers as Producers . *(Continued from page 10)*

producers and land managers, to bear on mitigating nutrient runoff. The farmers decided, as a group, to bank most of their payments to use as reimbursements to individual farmers for costs associated with voluntary conservation actions. We have found that under a performance-based approach, participating farmers are eager for data to help them better understand their watershed instead of being wary of studies that look at agriculture as a non-point source of pollution. They then use this data to make better decisions on where to place conservation practices.

This research partnership, funded by the USDA Cooperative State Research, Education, and Extension Service, National Research Initiative, will continue for at least two more years. A number of papers regarding different aspects of the experiment have been presented at symposia both around the USA and internationally. These papers and more information are available on our website.

We have found that under a performance-based approach, participating farmers are eager for data to help them better understand their watershed instead of being wary of studies that look at agriculture as a non-point source of pollution.

Deer Fence *(Continued from page 6)*

forested upland setting. It will measure natural recruitment of valuable native hardwood and other plant species, increase in overall species diversity, and changes to the soil structure of the forest floor. If the results are good, CI will prepare a downloadable "how-to" landowner's guide to preserving and restoring forested lands in support of Forestry for the Bay's 99,000 private landowners program.

CI's Director Neil Gillies gave a presentation in June 2008 on the riparian fencing study at the American Water Resources Association's premier national conference on riparian issues in Virginia Beach, VA. The talk resulted in partnerships that will expand the fence experiment into Pennsylvania, Maryland, and Virginia, as well as more sites in West Virginia. CI is looking for collaborators on this project who have, or will soon have, a riparian tree planting on their land. CI will provide technical assistance to private land owners who will make their site available for study. CI will provide technical assistance and help install and maintain the fence on public land.

If the experiment proves successful, this method could be used to economically increase success of riparian plantings in high deer density areas. It would also allow the use of much shorter tubes (for rodent protection) or no tubes at all, thereby reducing a major cost element of these plantings, and allow natural forest regeneration to occur.

More information on this project is available at http://www.cacaponinstitute.org/WVPTS/deerfence.htm

Early Test

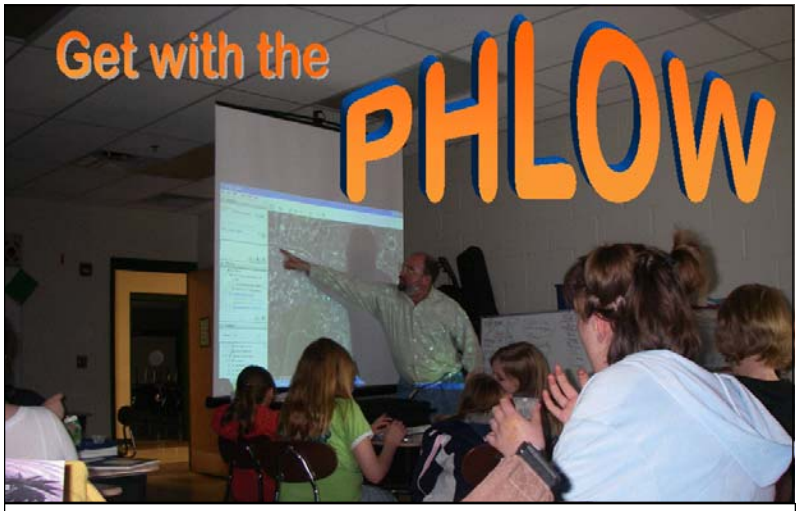
The fence design was initially tested in an informal experiment along Skaggs Run (a tributary of the North River, tributary of the Cacapon River). This site has a long history of excessive deer browsing, with little natural tree recruitment over the past 20 years. A variety of fencing configurations were installed, from 4 feet apart to 7 feet apart. After two years, these are the results:

- A significant amount of natural recruitment has occurred, including: black walnut, witch hazel, hornbeam, hophornbeam, linden, red maple, oak spp, hickory, dogwood, cherry, ash, box elder, tulip poplar, and locust.
- Only two protected plants have been browsed, those slightly.
- Every tree outside the fence exclosures has been heavily browsed.
- Three non-tubed plants were lost overwinter 2008 to vole damage.

Lack of browse in these areas offers the potential for proper forest structure and biotic community formation below the 6 ft browse line. Planting riparia is not just about the trees, it's about restoring the forest ecosystem.

Potomac Headwaters Leaders of Watersheds

Potomac Headwaters Leaders of Watersheds (PHLOW) is CI's service learning partnership with local schools that was funded and inspired by the WV Commission of National and Community Service's Future Leaders of Watersheds program. Service-Learning combines service to the community with student learning in a way that impacts both the student and the community. As youth participate in their community service projects, that actively meet community needs, youth develop practical skills, self-esteem, and a sense of civic responsibility. Service-learning values active learning that continues to ask young people: *What did you learn? What does it mean? What actions can you take with the knowledge you have gained?*



Frank Rodgers gives a lunchtime talk to PHLOW participants at Capon Bridge Middle School.

You don't have to be in the stream to have an impact on water quality. Impervious surfaces like buildings and parking lots and hard packed school "yards" can produce excessive storm-water run off.

CI's work with youth in the Eastern Panhandle has led to two significant service learning projects conducted during the 2007-2008 school year: one at Capon Bridge Middle School and one at East Hardy High School.

At Capon Bridge Middle School, Linda Mercer of Friends of the Cacapon River and social studies teacher Steve Bailes helped CI engage students in watershed education and hands on activities. Daniel Huffine and William Harvey, CI Stream Scholars and now students at Hampshire High, prepared a Power Point presentation for the 7th grade class that inspired 33 students to sign up for PHLOW. At East Hardy High School, vocational agriculture teacher Art Halterman engaged his class in service projects for the school and the West Virginia Conservation Agency to promote watershed health and education.

The students at Capon Bridge Middle School met many Fridays over lunch to learn about watershed dynamics and discuss non-point source pollution issues and best management practices to reduce sediment and nutrient pollution. Frank used the WV DEP's Project WET ground water model, a Plexiglas box full of sand, rock, and water, that looks a bit like an ant farm, and demonstrates how surface pollution enters the ground and then flows to streams, rivers, lakes, and the aquifer. Using the model students pumped "well water" out of the model to see how pollution can enter drinking water and to see how pumping from one well impacts the water table at nearby wells.

The Capon Bridge PHLOW students formed four teams; The H20's, Aqua Group, Minnows, and Yeeps! (say it like a frog would). Using a display created by the Friends of the Cacapon River, the students investigated how personal care products, pharmaceuticals, anti-bacterial soaps, and other pollutants can get down the drain and enter the water supply. Building on this information, they designed posters to display in their school to educate other students. The 8th graders raised $74 to support an education campaign and designed refrigerator magnets to get the word out on what not to put down the sink.

The students also learned the benefits of trees for watershed health. With the approval of CBMS Principal Downs and the grounds maintenance staff, students planted trees around the school to reduce

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PHLOW *(Continued from page 12)*

stormwater runoff. As they grow, the trees will also provide shade, habitat, and beautify the campus. After each lesson, or activity, the teams reflected on the day by writing an entry in their "diary". After the tree planting Danielle Lewis reported for the H20's:

"Friday April 25, we met outside and planted trees. We had a lot of fun! We planted firs and dogwood. Our leader, Frank Rodgers, and Linda Mercer taught us how to plant trees properly, and they told how this could help our environment. We put mulch around the trees and put a couple rocks in the middle just for decoration. We also put a lot of water on the trees to make sure they won't die."

At East Hardy High School the students learned about watershed through CI's online Potomac Highlands Watershed School. They installed a liner in the school's vernal (spring) pond and built "stream tables." The liner, provided by the WV Conservation Agency, restored a pond that was constructed many years ago but blown out in a flood. Vernal ponds, wet for only part of the year, are important as essential breeding habitat for a number of species, such as wood frogs and marbled salamanders.

The stream tables constructed by the East Hardy students are models used to demonstrate how streams shape the landscape through erosion. One large 3'x7', and three smaller 2'x4' tables were built. The five sided boxes are pitched at a slight angle and filled with sand, stone, and other types of "soil" and then water is pumped to the upper end in a continuous loop. The flow of water passing over, then through, the "river bed" causes erosion and produces a model of how a stream channel is formed in a flood plain. The stream table models are available for use at regional events and school education programs by the WV DEP, WV Conservation Agency, Conservation Districts, and of course CI. The smaller tables were designed to be easily transportable and carried by people of average strength.

CI plans to continue PHLOW at Capon Bridge Middle School and East Hardy and also expand the program to other area school. Continuing student programming is a complicated task though. (At Capon Bridge new restrictions on non-employee interaction with students has curtailed the program temporarily. At East Hardy our diehard partner, Art Halterman, has retired.) At Musselmen High School, Inwood, we have initiated a PHLOW program to map the "school-grounds-watershed" to look for non-point source pollution problems, then plan and implement solutions.

At Hampshire High School, Romney, WV, we are planning to work with students

PHLOW participants plant trees at Capon Bridge Middle School.

in the spring to construct a FLO (Fixed Location Observation) data recorder. FLO is a program of NOAA's Chesapeake Bay Program Office and designed to allow students to collect data similar to the Chesapeake Bay Observation Buoys (see: www.buoybay.org). We are seeking opportunities to expand PHLOW to more venues, including other schools and community youth organizations like 4H and scouts.

CI's partnership with West Virginia Commission for National and Community Service FLOW program has also helped strengthen and renew our regional partnerships with the Girl Scouts of Shawnee Council and the Potomac Valley Audubon Society.

Stream Scholars *(Continued from page 16)*

Mr. Craddock compared data taken this year with other data going back to 1997, which demonstrated that Waites Run is and remains a healthy stream. That is due in part to the good stewardship of Wardensville Town Park. They protect Waites Run from pollution by not cutting the thick forest that grows along the stream bank. This ribbon of forest, known as a riparian buffer, between the park grounds and the stream, protects Waites Run by reducing erosion, filtering pollution before it reaches the stream, and providing shade that keeps the water cool. We invite our members to take a good look at their local park. If there is a stream, do the lawn mowers cut right down to the edge? Establishing a no-mow zone and allowing plant regeneration on the bank of a stream or pond will do wonders for restoring habitat and water quality.

Streams Scholars pick benthic macroinvertebrates on Waites Run, Wardensville, WV.

On Thursday the Scholars headed to Washington D.C. for a day packed with activities. They first participated in a National Fish and Wildlife Foundation (a Cacapon Institute funder) grant award ceremony. The event included a ceremonial tree planting by the kindergarten students of Tyler Elementary School on Capital Hill. WV's Stream Scholars did much of the heavy work to help the little kids out. During the ceremony, Congresswoman Shelly Moore Capito stopped by to wish the Scholars well, thank them for their efforts, and encourage them to continue their community service.

After the award ceremony the Scholars walked to the senate Office Building to meet Senator Rockefeller. The Senator listened to stories about what the Scholars had been doing and shared a joke. Patrick T. Bond, one of the Senator's Legislative Aides, then took them off to a conference room to discuss current events.

The Scholars also visited the Senator Byrd's office, a virtual museum to his many years of service. There they met Caryn E. Compton, the Senator's Senator Legislative Counsel and liaison for interior affairs, and discussed environmental policy.

It was a thrill for the Scholars to meet their elected representatives and learn more about how government works. Cacapon Institute can not thank Congresswoman Capito, Senator Rockefeller, and Senator Byrd's staff enough for their time and attention.

Thursday night the youth camped at Point Lookout State Park, Maryland, where the Potomac River flows into the Chesapeake Bay. After making dinner, they played on a pier and saw some of the Bay's inhabitants, like jellyfish and crabs.

On Friday the Scholars visited the University of Maryland Center for Environmental Science Chesapeake Biology Laboratory and took a trip on the Research Vessel Aquarius, a 53 ton, 65 foot long ship equipped with a laboratory and an impressive array of scientific equipment. The students were guided on a two hour tour by Education Specialist Jackie Takacs, winner of the 2005-2006 Outstanding Sea Grant Extension Program Award by the Mid-Atlantic Sea Grant Extension Programs. While aboard the Scholars trawled for fish and plankton, sampled the river bottom, dredged for oysters, and utilized an $80,000 water sampler to test for temperature, salinity and other factors at various

(Continued on page 15)

Stream Scholars *(Continued from page 14)*

depths.

The Scholars all had fun, of course but, more importantly, they learned serious lessons about the science of keeping our waters clean and healthy. Grasping science early will help Stream Scholars become good environmental stewards. By learning about how government works and the importance of public service, the Scholars will become better citizens.

STREAM SCHOLARS SUMMER CAMP PHOTO GALLERY ON PAGE 8

During the coming school year some of the Stream Scholars will continue their activities with Cacapon Institute in the Potomac Headwaters Leaders of Watershed program. PHLOW offers student leaders special lessons on watershed science and works with them to develop their own watershed protection projects. By learning about and protecting our watersheds, the young leaders will help keep West Virginian's waters safe, clean, and beautiful.

Stream Scholars camp and the excursion on the research boat, while priceless for the youth, is an expensive undertaking for CI. We thank you, our supporters, the West Virginia Commission for National and Community Service's Future Leaders of Watershed program, the WV Conservation Agency, the MARPAT Foundation for financial support; WVDEP staff for training; and Mayhew Chevrolet (Romney, WV) for loan of a van.

Watershed

The area of land that delivers water to streams and rivers.

eForum *(Continued from page 4)*

Forum will run from March 9 to April 10, 2009.

When coupled with an outdoor, hands-on experience, like a ceremonial tree planting for Arbor Day, or construction of a rain garden for Earth Day, the SCE Forum completes a Meaningful Watershed Education Experience. CI has technical resources available to help participating schools obtain funds to implement their own watershed stewardship project. Classes might plant a stream buffer, draft a stream management plan, control erosion problems, launch an education campaign, or other best management practices. Schools don't need to be near a stream because terrestrial projects like controlling rooftop and parking lot runoff also improve water quality.

See some student projects on page 9.

Community Group Involvement

We are recruiting community based conservation organizations and natural resource professionals to mentor their local schools and participate in the eForums and use other eSchool activities. If your watershed or service group is working with a school, or wants to start, we encourage you to become a partner in education by participating as a mentor on the importance of conservation and civic engagement in problem solving. Groups can use the eForums as a tool to better engage their local schools in substantive curriculum based programs. At the same time they will strengthen their organizations by becoming better educated themselves, recruiting a new generation of members, and increasing their visibility and effectiveness in their community.

Fostering an educated generation of youth who are connected with their communities will ensure a sustained and growing core of volunteers to improve water quality, sustain habitat and living resources, and positively impact local watersheds. CI believes that achieving long term success in school based MWEE projects requires the involvement of the local community.

The Potomac Highlands Watershed School and eForums are supported by the MARPAT Foundation, the National Fish and Wildlife Foundation, NOAA-BWET, the USEPA, the Virginia Environmental Endowment, and the members of Cacapon Institute.

"Watershed leaders and environmentalists should reach out to students to teach stewardship. Adult mentors lend a real-world sense of importance to classroom learning."

-Laura O'Leary, North Harford H.S., MD

Youth Complete 6th Annual Stream Scholars Summer Camp

Muddy Hands. Stream Scholars on the Patuxent River.

Eight middle and high school students from Hampshire County enjoyed a week in July participating in Cacapon Institute's 6th Annual Stream Scholars Summer Camp, a hands-on exploration of stream ecology and conservation. They studied a WV stream, worked in a water quality laboratory, visited Washington D.C., cruised on a research vessel, and dug through slimy black muck dredged from the bottom of the Chesapeake Bay.

The Scholars spent the first three days in and around Waites Run at the Wardensville Town Park. The group conducted stream habitat assessments, biological assessments using benthic macroinvertebrates (animals without backbones that are visible to the naked eye and live on the stream bottom), and measured water quality. The Scholars also took water samples to Cacapon Institute's laboratory in High View for chemical analyses. Alana Hartman, WV DEP's Chesapeake Bay Coordinator, spoke to the youth about the importance of good school work and career opportunities in biology and science. Tim Craddock, WVDEP's Citizens Monitoring Coordinator provided the benthic macroinvertebrate training. The Scholars were joined by two Shawnee Council Girl Scouts who have been monitoring Waites Run as part of a Future Leaders of Watersheds program.

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