

TWINELINE

2011 WINTER/SPRING EDITION VOL. 33/NO. 1

Nanoparticles ? IN OUR DRINKING WATER ■

Researchers investigate
how a popular new
technology could affect
our Great Lakes waters
and ecosystems



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Tourism Program Featured in College's Annual Report

Ohio Sea Grant's Sustainable Tourism Program was one of 12 programs featured in the OSU Extension 2010 Annual Report. Available at go.osu.edu/Cuj, the report focuses on Program Director Melinda Huntley's leadership of Ashtabula County's first-ever Tourism Summit and the group's action plan to increase Lake Erie tourism, an \$11 billion industry along Lake Erie. The program was also a feature at the OSU Extension Legislative Luncheon in March, where Melinda discussed her work with decision makers from around the state. Pictured here from left to right are OSU Vice President of Agriculture and Outreach Bobby Moser, Ohio Representative Randy Gardner, and Ohio Sea Grant Tourism Director Melinda Huntley.



Ken Chamberlain OSU CommTech

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Nanoparticles

IN THE PRESENCE OF WATER

by Christina Dierkes

The word “nanotechnology” is most often familiar in the context of science fiction, but since the first nanomaterials were discovered in the 1980s, these tiny structures have become a part of new developments in the fields of medicine, engineering, and construction, and they have been integrated into consumer products from food storage to clothing.

However, with their increasing use, many researchers are beginning to raise questions about the ecological impacts of nanoparticles, with little known about their possible effects as they enter natural environment. Will they clump together into larger structures that could be eaten by fish and other aquatic organisms, possibly causing damage? Or will the larger clumps of nanoparticles settle to the bottom of a lake or stream where they could affect Lake Erie’s

benthic communities? Nobody really knows, and that could be a real problem.

To shed some light on the environmental fate of nanoparticles, Ohio State University professors John J. Lenhart and Harold Walker are investigating how silver nanoparticles behave in freshwater environments, such as lakes and streams. Their research, which is supported by Ohio Sea Grant, examines the fundamental properties of silver nanoparticles in water, starting with the basics of how dissolved nanosilver behaves in the presence of other chemicals under controlled conditions and ending with the behavior of silver nanoparticles in samples from different bodies of water in the Great Lakes region.

“The reason that we’re looking at the nanosilver is that compared to the other metal-based nanoparticles, nanosilver is the

one that is commercially being used already in many different applications,” Lenhart, Assistant Professor in Ohio State University’s College of Engineering, explains. Because the Great Lakes region depends on its lakes and streams for drinking water, agriculture, and industry applications, knowing what happens to these nanoparticles once they enter the water is an important step in managing the water supply for 33 million residents in the Great Lakes region.

Nanoparticles in Action

Silver nanoparticles are used in more than 200 different commercial products because silver is an effective antimicrobial agent. Nanosilver is included in some plastic food storage containers since it can help preserve stored foods and reduce bacterial contamination. Some clothing manufacturers

How Big are They?

Nanoparticles are so small that you could line them up side-by-side on the smallest of things.



Strand of Hair = 1,000 nanoparticles



Grain of sand = 10,000 nanoparticles



Head of a Pin = 100,000 nanoparticles



Tennis Ball = 6,700,000 nanoparticles

also include nanosilver in their textiles because the silver can reduce bacteria that cause odors—shoes and socks are likely the largest range of products in this area. And nanosilver has a range of medical applications—surgical instruments, implants, and even bandages—where its antimicrobial properties can be useful in preventing infections.

“In terms of the number of products, nanosilver is used more than pretty much any other manmade nanomaterial right now,” Lenhart says, adding that “its potential uses are quite a bit higher than those of any of the other nanomaterials.”

Nanoparticles can be either manmade or naturally occurring, and are characterized by their size of less than 100 nanometers (nm) across. With an average diameter of 10-20 nm, manmade nanoparticles are about ten thousand times smaller than a grain of sand. Despite their small size, these miniature structures have huge potential in commercial applications.

“They’re used for a couple of reasons: one reason is that particles of this very small size have a high surface area, which makes them a lot more reactive in applications that require some sort of reaction, like in terms of drug delivery,” Lenhart explains. “These

nanomaterials also have some very interesting optical properties, so as the particle changes in size, even by just a couple of nanometers, the color of the particles themselves can vary quite drastically to our eyes,” he continues. In the future, these properties could be exploited in optical interfaces like computer monitors and cell phone screens, for example.

Carbon-based nanomaterials like single-walled nanotubes—tiny tubes formed from a single layer of carbon molecules—have a very high strength-to-weight ratio, meaning that they can carry many times their own weight without breaking. These are very attractive to materials manufacturers, who “are trying to create a variety of different products and plastics that include these nanomaterials because they provide for increased mechanical strength at a very small cost in weight,” Lenhart says.

Little Stuff, Big Questions

While nanomaterials have a number of important applications, researchers and government officials have raised concerns about the potential dangers of incorporating nanoparticles into everyday products. As nanosilver is already being used commercially on a relatively large scale, these particles

are of particular concern to Lenhart and Walker because they already may be entering freshwater environments. Previous studies have shown that in products like food containers or clothing, where silver nanoparticles are used as an antimicrobial agent, the incorporated silver does not withstand very many wash cycles before it is released into the sewage system. From there, it may or may not be removed during sewage treatment, and could potentially be discharged into surface waters like Lake Erie.

Walker, Professor in Ohio State’s College of Engineering, explains that “with respect to nanosilver, the big concern is that most of its applications are for antimicrobial properties of the particles. That makes a lot of sense when you have applications where you want antimicrobial activity, but having the material out in the environment, antimicrobial properties become another concern.”

While a larger picture of the effects of nanosilver will also include toxicological studies, engineers Lenhart and Walker are focusing on where the nanoparticles are going to end up within certain environments.

“The industry of nanomaterials and nanotechnology is still in its infancy, and so how big it gets will ultimately determine how

much of these materials will eventually be released into the environment,” Walker says. “So I think there are three key questions: how much of this stuff is going to get out there, where is it going to end up, and once it reaches some location or receptor, ecological or human, what are the impacts?” Lenhart and Walker are focusing on the second question in their current research, but both agree that all three are important in understanding the potential risks of nanomaterials to the Great Lakes.

Lenhart adds that the relative ease with which nanosilver is removed from the commercial products that use it “provides some motivation to figure out: if these particles end up in a freshwater environment, what’s the potential outcome?” The emphasis of their research is to find out what processes and mechanisms will determine where nanosilver particles end up in the environment; depending on the results, further research can evaluate specific scenarios for organisms that live in those particular habitats.

“A number of people are looking at the other end—they’re saying the silver is going to be there and we have to select some aquatic organisms and see if these particles



Manufacturers continue to incorporate nanoparticles into consumer products like socks and tennis shoes. More than 1,300 products now use nanoparticles, an increase of 2300%, in only five years.

are toxic to them,” Lenhart explains. “We think that we need to figure out where the particles are going first before we do some more in-depth toxicological studies on adverse effects,” he adds.

Needed Research

The first part of their research project is already completed, and was published in September 2010. Lenhart and Walker, along with graduate student Xuan Li, determined how pure silver nanoparticles behave in water when common ionic substances (in essence, different salts) are added to the pure water. The researchers found that silver nanoparticles won’t be stable in natural environments: “The salt concentration you would find in most freshwater systems is going to be sufficient to cause these particles to aggregate (or clump together), and then eventually they’ll settle out into the sediment,” Lenhart explains.

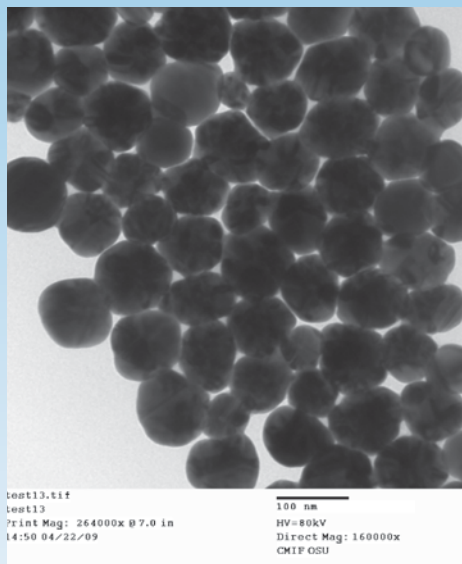
At the same time, the nanosilver particles dissolve relatively quickly in the presence of chloride ions, a common part of many salts. Between this aggregation and dissolution, the particles eventually reach a dynamic system where silver is dissolving as quickly as it is aggregating and settling. However, that’s not what the researchers expected to find.

“The silver particles dissolve quickly, under certain conditions within a manner

of minutes to an hour, but then they reach a stable condition, and we’re not certain what stops the dissolution,” Lenhart says. “Thermodynamically they should dissolve completely, but we don’t observe that. It’s almost as if at some point maybe they’re getting armored to some extent with the formation of a coating layer that resists further dissolution,” he continues. The researchers’ planned follow-up studies will continue to investigate this phenomenon to determine what causes the particles to not dissolve completely.

“The dynamic nature of these particles is really surprising to us,” Lenhart concludes. “That’s something I think is unique to these silver particles, that their behavior in the environment is quite a bit different than any other particle that we’ve ever looked at.” This unusual behavior will also continue to play a central role in the next phase of Lenhart and Walker’s project, which will investigate the effects of coating layers added to industrial nanosilver on the particles’ behavior in freshwater. **TL**

Stay tuned for part two of the Nanotechnology Series, where you will be introduced to more details of this extensive research project. And visit ohioseagrant.osu.edu for more information on research sponsored by Ohio Sea Grant, as well as its other educational initiatives.



OSU researchers Lenhart and Walker are examining what happens to nanosilver particles (like these pictured) once they wash out of consumer products and get into our waterways.

TAKE-HOME LESSON

COSEE GREAT LAKES PROGRAM REVIEW

by Matthew Forte, Ohio Sea Grant Communications

Students in most Great Lakes school districts don't get a chance to learn much about the lakes. Apart from a few general questions about fresh water on their standardized tests, schools' curricula largely ignore the lakes. And even though they form the world's largest freshwater ecosystem, the only mention of the lakes in most textbooks (if there is any mention at all) is that glaciers carved them or that zebra mussels are an example of invasive species.

Since 2006, Dr. Rosanne Fortner and the Centers for Ocean Sciences Education Excellence (COSEE) Great Lakes have made strides to bridge this education gap. As part of the COSEE national network of centers formed by the National Science Foundation (NSF), COSEE Great Lakes and its Sea Grant partners have provided educators with teaching material and energized them to use the Great Lakes when teaching science.

"If there's nothing in the textbook, teachers don't have resources to depend on," Fortner says. "With COSEE, we've been able to get curriculum materials out there and show teachers how to incorporate Great Lakes information into their classrooms. We also

assisted teachers in learning Great Lakes science from scientists themselves."

Ohio Sea Grant has been doing this type of educational outreach for more than 30 years, but coordinating several states' programs is difficult, Fortner says. As a separate project that involves all Great Lakes Sea Grant programs and receives half of its funding from the National Oceanic and Atmospheric Administration, COSEE Great Lakes draws together scientists and educators to put Great Lakes information into the curriculum.

"All of us in the region tell the same basic story," Fortner says. "While each Great Lake is unique, the Great Lakes story is one message."

This year NSF is reviewing all COSEE centers to determine if the program should continue to be funded. Fortner says that even if NSF decides to no longer fund COSEE, the Great Lakes center has gained so much that the work of teaming multiple Sea Grant programs together to link scientists and educators can continue through other funding sources.

Reaching Educators

Looking back on its five years, it's clear that COSEE Great Lakes has been successful in fostering scientist-educator collaboration and increasing the presence of the Great Lakes in school curricula.

For many educators and scientists, the highlight of their COSEE Great Lakes experience was the yearly *Shipboard and Shoreline Science* workshops, which immersed educators in the world of Great Lakes science. For a week each summer, 15 educators from around the Great Lakes region worked alongside scientists,

participating in Great Lakes research on the U.S. Environmental Protection Agency's Great Lakes research vessel *Lake Guardian*. The workshop visited each of the five Great Lakes over the five-year project.

Time on the *Lake Guardian* brought science to life for Sam Roman, who teaches fourth and fifth grade. He learned geology, geography, ecology, weather, and other sciences by working with scientists to collect and analyze data. "Bringing those experiences back to the classroom is really powerful," he says.

In Roman's classes at Cleveland's International Newcomer's Academy, he uses pictures and videos of his research experiences on the *Lake Guardian* to explain concepts and to show that science isn't overwhelming.

"We were talking about water one day and a student asked why some water looks green," Roman recounts. "I said, 'The microscopic plants that live there make the water green.' Many of the students had no clue what I was talking about, so I just put in a video clip I took of teachers using microscopes to look at algae and plankton aboard the *Lake Guardian*. Then it made sense."

The hands-on science was exciting for the educators and that will transfer to students," says Dr. William Edwards, Assistant Professor of biology at Niagara University, who participated in some *Lake Guardian* workshops. "We want to reach out to our young people and let them know that science is cool and not something to be afraid of," he says. "We do that by making science fun and exciting for their teachers because students understand their enthusiasm."

Teachers were excited to show everyone on board what they had found in their water-



Educators within COSEE Great Lakes worked side-by-side with top scientists to conduct research and develop new school curricula using real-time Great Lakes data.



More than 3,000 students have learned science firsthand on research vessels and in land-based workshops, thanks to the NOAA- and NSF-funded Great Lakes program.

sampling, Edwards says. “This was data they had gotten out of the water themselves and they understood it because they had learned about it that week.”

COSEE Great Lakes evaluated how much the teachers learned while on the research vessel by using a technique known as concept mapping. At times throughout the workshops, teachers created diagrams to show how lake facts fit together. Each map was a snapshot of what a teacher knew at that moment.

“At the beginning of a cruise, teachers may have known three or four interrelated facts about Lake Erie, and those might not all have been accurate,” Fortner says. “We ended the workshops with diagrams that showed a much larger body of knowledge and how those pieces of information were connected. These workshops were extremely effective at helping teachers see the connections across the sciences.”

Other week-long *Lake Exploration* workshops were land-based, bringing

educators and scientists to a lakeside area and introducing them to resources accessible from land. For Lake Erie, participants began in Erie, PA, at the Tom Ridge Environmental Center and learned their way to Stone Lab through stops in Painesville and Old Woman Creek National Estuarine Research Reserve. A week’s learning included hands-on, feet-in lessons for the lake’s land, water, life, weather, and special issues, such as invasive species and eutrophication.

Half-day and daylong workshops, called *Teachable Moments*, provided educators with materials to teach about their state’s Great Lake. All five lakes hosted these shorter programs every year. In Ohio, for example, events at Old Woman Creek and the Great Lakes Science Center in Cleveland attracted educators to learn about Lake Erie.

Teachers who had never been able to study the lakes first-hand came to the *Shipboard* and *Teachable Moments* workshops. “They brought their own skills and talents and disparate



Over the last five years, COSEE Great Lakes has brought 180 scientists together with nearly 1,250 educators to get Great Lakes material into classrooms.

teaching situations, and they learned how to teach about the Great Lakes,” Fortner says. “We have all kinds of anecdotal information about new curriculum being planned, new

Great Lakes courses being developed, teachers leading class field trips to the lakeshore for the first time, and new lessons being made, all as a result of COSEE workshops.”

Over the summer of 2010, COSEE Great Lakes finalized the eight Great Lakes Literacy principles to guide educators in their teaching of the Great Lakes. With support from COSEE California, a group of 80 scientists and educators edited the literacy principles for scientific accuracy and adherence to national science standards. Ohio Sea Grant recently designed a website, greatlakesliteracy.net, which links teaching resources with each of the principles.

“The website pulls together important resources for educators and scientists who are using and teaching these principles,” Fortner explains. “A scientist can find out how his or her research fits into curriculum for outreach purposes and a teacher can find out where the education standards match the literacy principles.”

In addition to providing a framework for teaching about the Great Lakes, COSEE Great Lakes created two sets of educational activities

for educators to use in their lesson plans. Of these activities, 41 cover water sciences and 14 lessons apply the Great Lakes Literacy principles to a set of actual Great Lakes data to teach students about lake sciences.

The COSEE Great Lakes Ocean/Lake-Aware Kids Engaged in Relevant Science program (O’LAKERS) funded field trips for more than 3,000 inner-city youth, Native American students, and others to visit science facilities, including Ohio State University’s Stone Lab and the Great Lakes Aquarium in Duluth. As they interacted with science exhibits and natural environments, or analyzed data they had collected themselves, students learned about the interactions among components in the Great Lakes ecosystem.

To help scientists reach out to educators and the public, COSEE Great Lakes organized Schools for Scientists at the 2007 and 2009 meetings of the International Association for Great Lakes Research (IAGLR). Teams of scientists and educators, expert communicators, and IAGLR leaders presented tips to help researchers make a broader impact with their science. COSEE



Annual half-day and daylong workshops in each state provided educators with materials to teach about their Great Lake.

also conducted Educator House Calls, with teachers bringing their “prescriptions” for collaboration and education into research facilities so scientists could learn from them firsthand.

Continuing Contributions

Fortner says COSEE Great Lakes has served as an example to other COSEE centers because of its success in spreading awareness of the Great Lakes. “People are starting to mention the Great Lakes alongside ocean sciences,” she says. “When COSEE brought people from all over the country up to programs at Stone Lab and other states’ facilities, they were impressed with how much they learned and how much ocean science they could do on our vessels.”

“Our biggest gift was to raise awareness of the wonders of the lakes, the science opportunities for curriculum, and the responsibilities people have for the health of the region,” Fortner says. “By example, by tone, and by the kinds of demonstrations we did with water quality issues, it became very clear to people that they have to work together to maintain a healthy ecosystem.”

Teaching and talking about science won’t be the same for the scientists and educators who participated in COSEE Great Lakes workshops.

“Now I can’t drive by a body of water without seeing the whole system—everything that lives in the water, around it, and from it,” Roman says. “That’s what COSEE showed me. What I learned permeates every subject area I teach.”

“It was basically life-changing.”

For more information about COSEE Great Lakes, visit coseegreatlakes.net. TL



Educators from around the country received scholarships for a one-week science immersion with researchers aboard the U.S. Environmental Protection Agency’s research vessel, *Lake Guardian*.

Sea Grant Leads Synthesis Team for Ohio's Great Lakes Research

by Matthew Forte, Ohio Sea Grant Communications

Ohio Sea Grant and the Lake Erie Commission are leading a team effort to make 30 federally funded research and conservation projects around Lake Erie more efficient and easier for the public, resource managers, and decision makers to understand. By working together, these projects can share resources, reduce costs, and make the projects more useful to both scientists and managers.

In late 2009, Ohio agency and university scientists made their proposals for Great Lakes Restoration Initiative (GLRI) funding part of a collaborative effort called the Lake Erie Millennium Collaboration. This group approach, facilitated by Ohio Sea Grant, the Lake Erie Commission, and the University of Windsor, made each project stronger and made their overall impact greater than the sum of the parts.

"We know there is great value in linking managers with research scientists early in the process of developing proposals and throughout the projects," says Jeff Reutter, Ohio Sea Grant Director. "It allows research



scientists to influence management decisions and managers to influence research project design."

A crucial part of Ohio's collaborative effort is a synthesis team led by Ohio Sea Grant and the Ohio Lake Erie Commission. The team of 17 scientists and managers will produce annual synthesis reports to explain project results and what they mean for citizens. "We want to heighten people's understanding of the issues, not only the projects we're working on, but we want to explain why we're working on them," Reutter says.

Ohio's projects that are contributing to this synthesis effort received nearly \$19 million from the GLRI to restore habitats for native species, reduce pollution, control invasive plant species, replace forest habitat, make public beaches safer, and reduce soil loss through erosion.

For more information about Ohio's GLRI-funded projects, visit lakeerie.ohio.gov/GLRI.aspx. TL

ODNR Honors Sea Grant and Stone Lab Leaders

by Matthew Forte, Ohio Sea Grant Communications

Three individuals with strong ties to Ohio Sea Grant and Stone Laboratory received awards in December from the Ohio Department of Natural Resources (ODNR) for contributing to the conservation and protection of Ohio's natural resources.

Lisa Kutschbach-Brohl, a Stone Lab teacher and previous Friends of Stone Lab board member, received the Cardinal Award, recognizing her protection of natural resources with the creation of the Lake Erie Island Chapter of the Black Swamp Conservancy. Under Kutschbach-Brohl's leadership for the past 10 years, the conservancy has coordinated the purchase and protection of several ecologically sensitive areas on South and

Middle Bass islands. Kutschbach-Brohl is also a commissioner of the Put-in-Bay Township Park District.

For their "devotion to furthering the best interests of natural resources management, conservation, or preservation," Dr. Ronald Stuckey and Carl Anderson earned induction into the Ohio Natural Resources Hall of Fame, ODNR's highest honor. They join the 155 people inducted into the Hall of Fame since 1966.

Dr. Stuckey, a preeminent authority on aquatic and wetland plants in Ohio and North America, has written more than 100 scientific papers and numerous books. He was a botany professor at Ohio State University and Stone Lab from 1965 to 1991, and an endowment in Dr. Stuckey's name

supports biology professors at Stone Lab.

ODNR posthumously inducted Anderson to recognize his efforts to restore the Ashtabula River. Anderson helped create and carry out the Ashtabula River Remedial Action Plan and gave several public presentations about the clean-up effort. Active with Ohio Sea Grant as a member of advisory committees in Northeast Ohio, Anderson promoted boating safety through his involvement in the U.S. Power Squadron, Sea Scouts, and Spirit of America.

We congratulate these individuals whose lives have focused on the same efforts that are central to Ohio Sea Grant—preservation, protection, and management of our natural resources. TL

From the Brink

Researcher's Efforts Lead to Recovery of Threatened Snake Species

by Matthew Forte, Ohio Sea Grant Communications



Just go to where the crowd gathers and you'll no doubt find her. Armed with educational brochures in one hand and snakes in the other, Kristin Stanford, or the Island Snake Lady as the Lake Erie locals call her, has spent the last 10 years working to bring the species back from the brink of extinction. From talking to hundreds of school groups to working with government agencies and grassroots organizations, Kristin is teaching people about the importance of the Lake Erie watersnake. Now, with a national conservation award in hand and the snake about to be taken off the Threatened Species List, you'd think Kristin would sit down and take a breath. But in her eyes, there is more work to do and more people to reach. She's just a scientist with a passion for something that slithers.

When Kristin started working with the Lake Erie watersnake (LEWS) in 2000, she was a graduate student at Northern Illinois University (NIU). Kristin spent three summers tracking migration and seasonal habitat patterns to understand why the

animal's population was dangerously low. The U.S. Fish and Wildlife Service (USFWS) had listed the snakes as federally threatened and identified humans as one of the main reasons the LEWS population had dropped to nearly 2,000 animals.

Since they live only around the western Lake Erie islands, the snakes would be gone forever if their population didn't rebound. The task of countering bad public opinion fell to Kristin. NIU funded her as a research associate, but she gave herself the title of Recovery Plan Coordinator so the locals wouldn't think she was just another researcher who would study the animals and then leave.

Kristin quickly orchestrated a powerful outreach campaign and it didn't take long for Lake Erie locals to see her dedication to answering their questions and protecting the snake. Spending about half of her time researching the snakes and the other half advocating for them, Kristin worked to change people's opinions of the harmless animals. Now, the snake has reached a population of nearly 12,000.



Through an aggressive public relations campaign and tireless research efforts, Kristin Stanford has been largely responsible for the rebound of the threatened Lake Erie watersnake. Her work to catch, tag, and monitor the snakes, as well as educate the public about the animal's importance, has helped grow the population from 2,000 animals in 1999 to nearly 12,000 now.

By speaking at public schools and teaching herpetology courses at Stone Lab, Kristin is educating and energizing the next generation of conservationists. The *LEWS News* newsletter she helps write and her "Ask the Snake Lady" newspaper column allow people to ask questions and learn ways to deal with snakes on their property.

An annual snake census, the Nerodio, Kristin organizes combines research and outreach. The name is a play on the LEWS genus *Nerodia* and "rodeo," because the event is basically a snake roundup, Kristin explains. Since 2002, the two-week event



Kristin was one of 20 scientists nationwide to receive the U.S. Fish and Wildlife Service's Recovery Champion award in 2010. The agency has called her 10 years of research and outreach for the snake a "remarkable success story and a species turnaround in a very short time." Pictured here with Kristin from center are Ohio Sea Grant Director Jeff Reutter, OSU Vice President of Agriculture and Outreach Bobby Moser, and OSU President E. Gordon Gee.

sees as many as 60 scientists and snake enthusiasts searching the nine U.S. Lake Erie islands, catching, and tagging snakes.

Using Ohio State's Stone Lab as her home base makes Kristin accessible to the public. "I could not have accomplished what I have without the help Stone Lab has given me," she says. "It's provided me an office where residents can find me and a phone so people can get a hold of me."

As the Stone Lab's Outreach Coordinator, Kristin helps arrange public outreach and education events that highlight the important research taking place at Ohio State University's Island Campus. NIU, Ohio Department of Natural Resources (ODNR), and USFWS also provide support to Kristin.

Kristin's outreach efforts aren't confined to just Lake Erie residents. During the summer of 2006, she brought the LEWS' plight to the nationwide audience of the Discovery Channel's "Dirty Jobs with Mike Rowe." The camera crew filmed Kristin and the show host as they collected snakes, then weighed, measured, and marked them with identification tags. The episode lived up to the show's name as the snakes showered the two in foul-smelling feces and musk before being forced to regurgitate partially digested fish. Meanwhile, the snakes were also trying to defend themselves by biting.

So, what has been the result of Kristin's dirty work and unrelenting outreach effort? Success.

Surveys say people's opinions toward the snake are becoming friendlier and human-caused deaths are decreasing. Population estimates from recent census work have met the recovery plan's goal and the USFWS is finalizing the process to delist the LEWS.

Kristin's outreach efforts have led to changed opinions because of her consistency. "Because I was fortunate enough to be around the islands all the time and people knew I would be back, that gave me some credibility," she explains. "You're not going to buy something from the door-to-door salesman, but from someone who has a store and you see around town."

Reaching out to kids was also an important part of her success. Even though some angry parents leave her screaming voicemails and strongly worded emails, they eventually change their minds. "Anytime you can get kids excited about something, their parents tend to listen a little more," Kristin says. "They see how excited their kid is and they thank me. I can't count the number of times I've heard, 'I still don't like those snakes, but I think what you're doing is good.'"

The change in public opinion and a healthy population size have been two steps toward removing the LEWS from the Threatened Species List. Kristin was instrumental in the third step as well—creating safe habitat for the snake.



Kristin's research found that the LEWS often stay within 13 meters of the shore. This finding helped her work with agencies, private landowners, and the Lake Erie Islands Chapter of the Black Swamp Conservancy to permanently protect 11 miles of shoreline and 300 acres of habitat for the snake. In 2008 Kristin and her mentor Dr. Richard King of Northern Illinois University, who has been researching the LEWS since the 1980s, relocated LEWS to protect the animals during the Middle Bass Island Marina construction and built two artificial hibernation areas.

To recognize Kristin's and King's numerous contributions to the recovery and conservation of the LEWS, USFWS awarded the duo the National Endangered Species Recovery Champion Award last spring. They were two of the 20 nationwide recipients. "This is the biggest honor I've ever been awarded," Kristin says. "Rich and I were definitely humbled to be in the company of the other recipients."

Removing the LEWS from the Threatened Species List isn't the end of Kristin's work—there is plenty more to do. A post-delisting monitoring plan will help researchers keep tabs on the LEWS population over the next five years to make sure it remains stable and doesn't face any new threats.

Seeing the LEWS through the listing and delisting processes is a unique honor. "It's fantastic," she says. "It's very rare that a person gets to be involved from the start of the listing of a species and be able to see it through. And for those people who have, a species usually gets listed near the beginning of their career and comes off the list at the end of their career. I'm so fortunate that this all happened right at the beginning for me." TL

Setting Aside the Western Reserve

Study Looks at Heritage of America's 'Town Square'

by Matthew Forte, Ohio Sea Grant Communications

From NASA's Glenn Research Center and the first padded bicycle seat to the formation of Alcoholics Anonymous and leadership in the women's suffrage movement, there's a lot of history worth preserving in the Western Reserve. With its mix of cultures and innovative thinking, the 14-county area in northern Ohio has not only had an unquestionable impact on the United States, but has also been a microcosm of the entire nation.

Led by the National Park Service (NPS), a team is wrapping up its study of the region's historical, environmental, and cultural resources that contribute to the Western Reserve story. The project is in response to a Congressional request to determine if the region is feasible for designation as a National Heritage Area.

"Heritage Areas are about using what you have and working together to help the existing property owners," says Melinda Huntley, Ohio Sea Grant's Sustainable Tourism Program Director. "People in the communities come together to make management strategies to protect and promote the unique characteristics of their area."

There are 49 National Heritage Areas across the country, including two in Ohio—the National Aviation Heritage Area and the Ohio and Erie Canalway. To explore adding the Western Reserve to that list, U.S. Representative Tim Ryan of Niles (D-17) introduced legislation that directed the NPS to study the area. Heritage areas can also be developed as regional initiatives, the recommendation NPS put forth for the Western Reserve.



The National Park Service led a year-long study to determine the feasibility and suitability of designating Ohio's Western Reserve a National Heritage Area. The designation would bring the region national recognition and support from the NPS to preserve the region's stories and historic landmarks.

NPS Outdoor Recreation Planner Rory Robinson coordinated the study with a seven-person team including Huntley; Dan Rice, Ohio and Erie Canalway Coalition president and CEO; and other representatives of the NPS and the Ohio Historical Society. The team relied on an advisory board of local residents and organizations to help plan and promote public meetings, gather information, and serve as a sounding board. The final report is available for public review at go.osu.edu/C4N.

While most National Heritage Area assessment studies return a neutral analysis

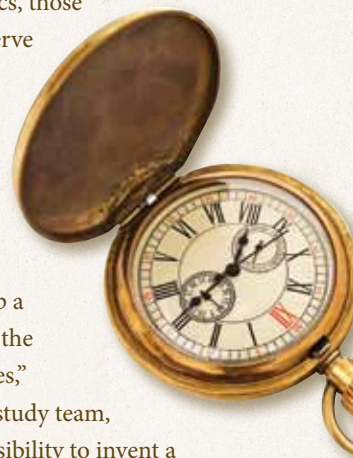
of the current situation, the Western Reserve Study Team took a unique approach. Before starting the study, the team members committed to create a report identifying strategies and opportunities to move the heritage area concept forward as a regional project, regardless of whether national designation occurred.

Rice says the Western Reserve study is breaking new ground by including these recommendations. "Previous studies just told Congress, 'This is what we found,'" he says. "It's one thing to do a study and just take the pulse, but because these are complex projects, we owe it to the region's citizens to help them plan. Let's help these folks understand what a National Heritage Area is and how to make it succeed. Let's give them the tools they need."

Taking Inventory

To inventory the region's resources, the Study Team called upon the region's residents. More than 30 public meetings at different phases of the yearlong study offered the public opportunities to report the region's unique characteristics, those things Western Reserve residents value.

"It's only after you identify the elements that make a community unique that you can develop a strategy to preserve the culture and resources," Huntley says. "As a study team, it wasn't our responsibility to invent a

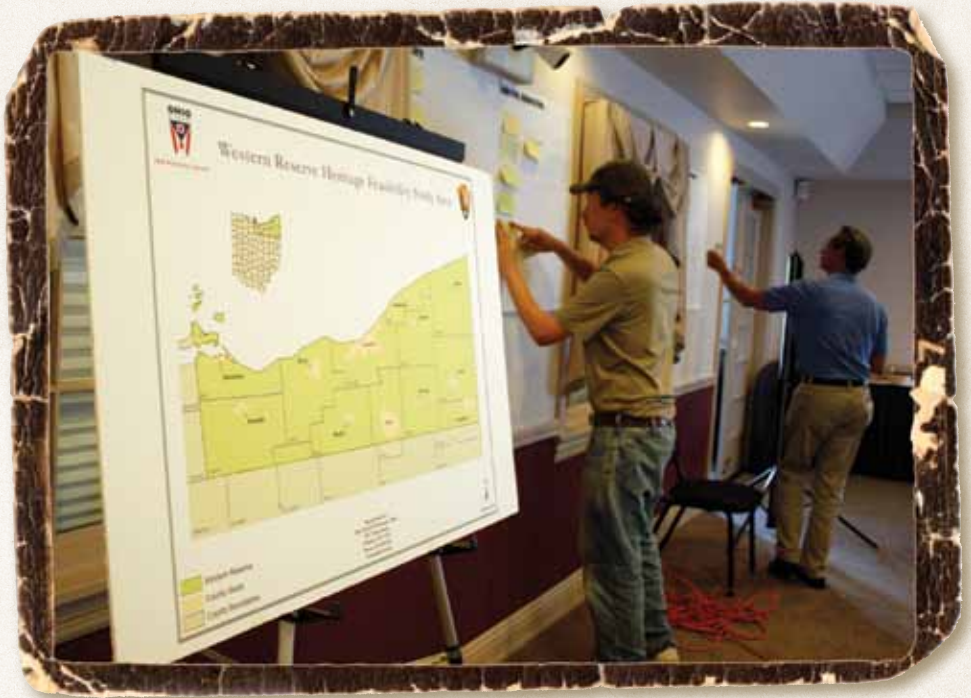


story. Our job was to reveal and record the stories the residents told.”

Western Reserve residents said the region is the nation’s “town square.” As New Englanders settled and built on the land, they brought with them the architectural town square concept, but socially, the region became a town square where creativity and fresh thinking is the norm. After all, this is where many important movements started and gained momentum—abolitionism, women’s rights, civil rights, labor laws, and environmental protection.

“The town square concept emerged because that’s where you meet and mingle, where you talk about events, do business, and even protest,” Huntley explains. “People did all those activities in the Western Reserve and this progressive thinking wasn’t just in the past. There are still remarkable advances in polymers, medical sciences, and environmental protection in this region.”

Many early settlers came to the region with strong Puritan beliefs. Later, waves of immigrants from several parts of the world brought new customs and beliefs. Creating diversity and encouraging creativity, this mixing made the Western Reserve representative of the entire nation’s “melting pot,” according to residents.



Using 30 public meetings to gather citizen’s input, the National Heritage Area Study Team inventoried the Western Reserve’s important historic, environmental, and societal resources.

“We celebrate our differences,” one resident said at a public meeting. “After all, it was our mix of cultures and people that created our specialness.”

Residents categorized the Western Reserve’s influences on the nation into themes of the region’s story—migration, education and social reform, land use and architecture, transportation, industry, and Lake Erie.

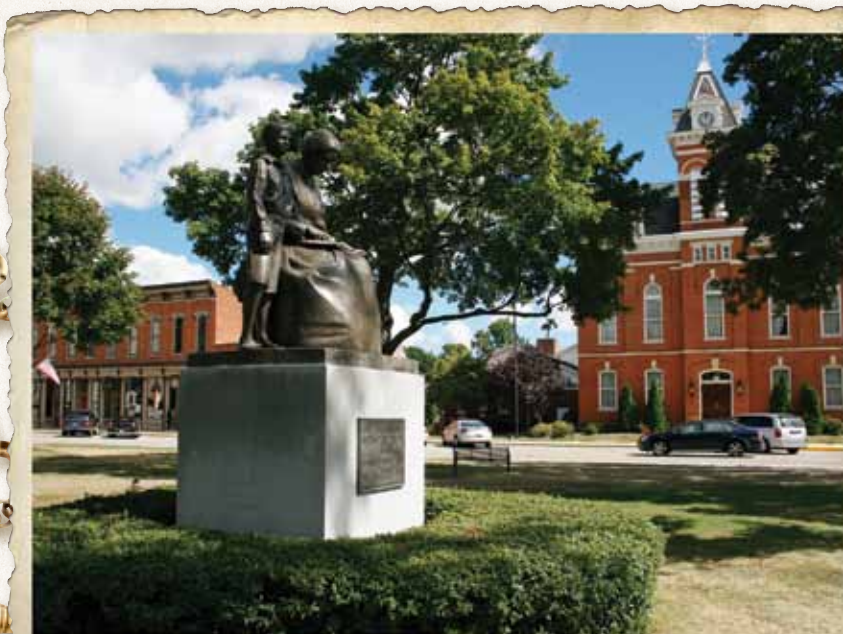
Next Steps

The feasibility study has reminded Western Reserve residents of their unique past and rekindled pride in their hometown. It has also found more opportunities to market the region and by involving residents, the study has promoted regional teamwork. The Western Reserve doesn’t need the national designation for these things to occur.

“We’ve already pulled together a group of stakeholders that geographically represents the Western Reserve and a mix of skills and interests, from parks to historical societies to city planners,” Robinson says. “The possibility is there now that we could move forward without the designation.”


The project’s next step may be for the current stakeholder committee or a regional organization to continue building collaboration as a heritage area. By holding regional public meetings and workshops, the organization can build a strong regional identity.

And the people of the Western Reserve can continue writing the region’s story as a place of innovation, reform, and diversity. TL



GLOBAL CHANGE **LOCAL IMPACT**

OSU Climate Change Webinar Series



Diverse ecosystems like Great Lakes forests are thought to be more resilient to the effects of climate change because they harbor a lot of biodiversity that allows them to better adapt to new environmental conditions.

Accounting for Carbon in Great Lakes Forests

by Christina Dierkes

When most people think of the term “accounting,” they think of banks, money, and profits. But in a world affected by climate change, accounting for carbon is one of the tools researchers use to determine the consequences of climate change and suggest ways to mitigate the problem.

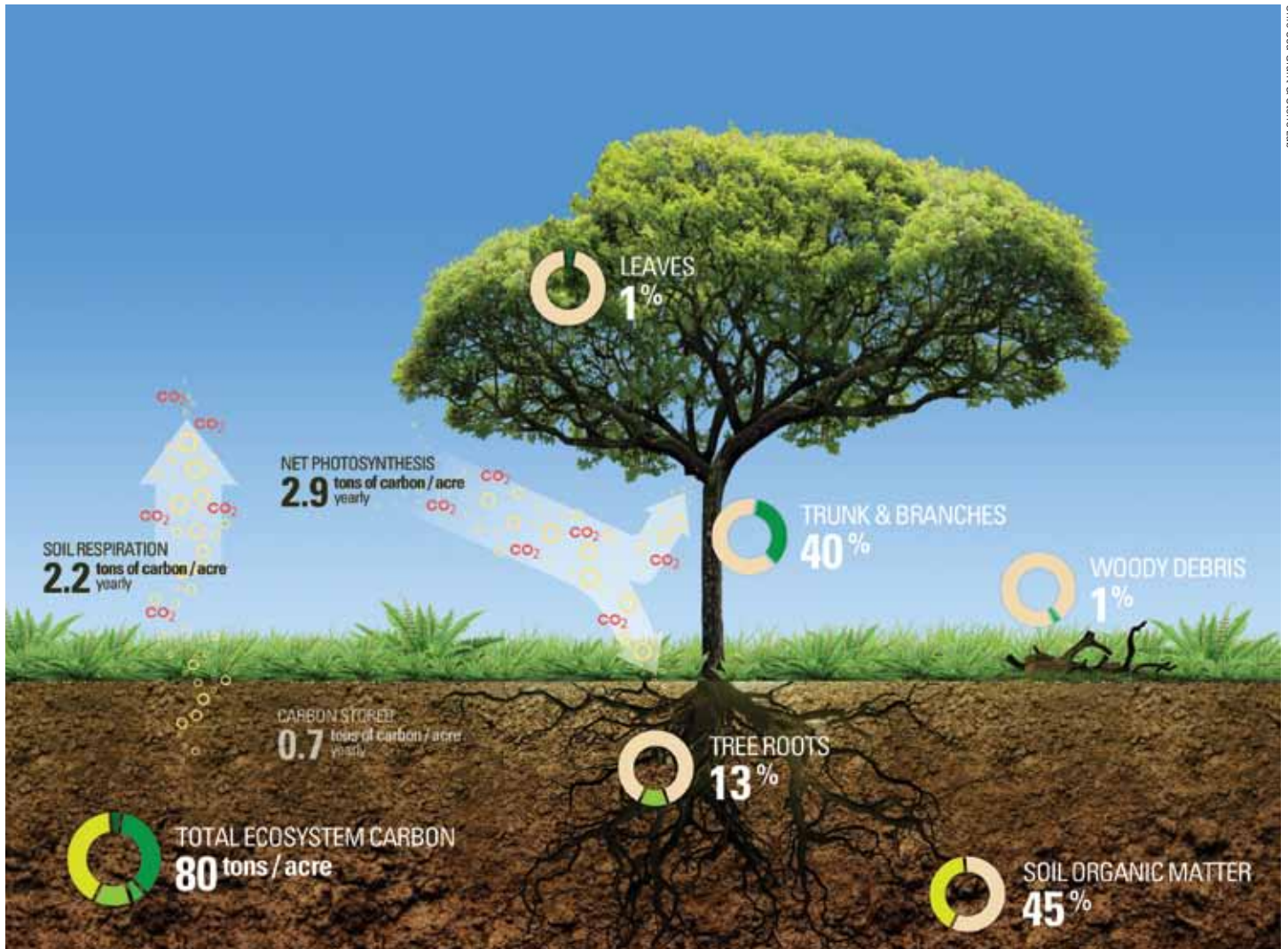
One of these researchers is Dr. Peter Curtis, a professor in and Chair of the Department of Evolution, Ecology and Organismal Biology at Ohio State University. Curtis studies the flow of carbon into and out of Great Lakes forests, and often introduces himself as a “carbon accountant” to those unfamiliar with his work. “Just like an accountant would do accounting for money at a business, we’re interested in how much carbon goes in and out of a forest,” Curtis says. His research

at the University of Michigan Biological Station in northern Lower Michigan has been going on for over 20 years, and is likely the only experiment in the world that tests the prediction that aging forests in the Great Lakes region continue to store carbon.

Researchers who study carbon cycles are interested in the “net loss or gain” of carbon in forest ecosystems over time, potentially answering the question “is this ecosystem a carbon sink, where carbon is being stored or sequestered, or is it a carbon source where carbon is being lost from the system,” Curtis explains. “Conventional theory predicts that as forests age, as they get to be around 100 years old, the rate of carbon storage slows dramatically and may go to zero as forests approach the old-growth stage, so that uptake and release are equal—losing carbon at the same rate as gaining carbon,” he adds.

Testing this theory is not easy, but data from projects at the Biological Station have shown that this reduction to zero carbon storage may happen in forests that are about 800 years old, but not in most Great Lakes forests, which are generally no older than 80 to 120 years. “These middle-aged forests are continuing to store substantial amounts of carbon,” Curtis adds.

Forests will store carbon by photosynthesis, a process in which green plants take in atmospheric carbon dioxide and convert it into sugar. The sugar feeds the plant and helps it create new branches and leaves during its growth. This process locks the carbon that was previously present in the atmosphere into the plant, essentially making it inactive in terms of its effects on the climate. Because carbon dioxide, or CO₂, is a major greenhouse gas, plants and



Carbon Cycling: A forest's carbon pool is spread across all parts of the ecosystem, generally with slightly more stored belowground in roots and the soil than aboveground in trunks, branches, and leaves. Up to 80 tons or more of carbon can be stored in an acre of Great Lakes forest depending on location. While photosynthesis takes in about 2.9 tons of carbon in that same area each year, decomposers only release 2.2 tons of carbon, allowing these Great Lakes forests to remove an additional 0.7 tons of carbon per acre from the atmosphere each year.

especially trees are an important player in the effort to mitigate global warming. In addition to locking carbon into the main body of the tree, an exchange of nutrients between the plant and the soil adds carbon compounds to the ground as well, further binding carbon that could otherwise impact the world's climate.

Like other living organisms, plants also respire, or “breathe out,” CO_2 . This releases carbon into the atmosphere, as does the decomposition of organic matter in the soil by micro-organisms. In addition, cutting down trees as part of forest management or for timber adds active carbon back into

the cycle, as woody debris and exposed soil organic matter begin to decompose almost immediately. Balancing the effects of carbon storage and carbon loss therefore becomes an important part of managing forests for climate change.

“The health of our forested lands is one way that we offset our national carbon footprint,” Curtis reasons. In a world where burning fossil fuel adds CO_2 to the atmosphere 24 hours a day, forests help offset fossil fuel carbon emissions and thereby slow the rate of atmospheric carbon dioxide increase and its accompanying effects on the climate. Knowing which

management practices—whether they concern large public parklands or just the trees in someone's backyard—best maintain a high level of unreactive carbon in the soil and in trees can help professionals and laypeople alike turn the local carbon cycle in favor of mitigating climate change. And that knowledge often comes from scientists like Curtis and his colleagues.

Curtis' findings on current carbon storage in Great Lakes forests are an important factor in how these forests can be managed as part of climate change mitigation: should these “potentially old forests” be cut and replaced with young, rapidly growing

forests which may store more carbon, despite the process of harvesting releasing substantial amounts of carbon as well? Or should the current Great Lakes forests be managed so they can acquire characteristics of old-growth forests, which are more biodiverse and may be more resilient to climate change? “That’s an interesting and potentially very important topic for forest managers if you’re managing with climate change in mind,” Curtis explains.

Located in the heart of the Great Lakes forests, the woods of the Biological Station share a management history that is very typical of forests across Great Lakes states like Michigan, Wisconsin and Ontario, as well as Ohio. 150-foot towers measure the flow of carbon dioxide as it enters and exits above the canopy of the trees, and researchers on the ground measure everything from fallen leaves to soil carbon content to the bug population to determine the size of the carbon pool, or the overall amount of carbon present in the research area. Carbon cycle data from the research has already been used by the United States Forest Service to inform its management of national parklands, and it will become more important as international climate treaties recognize the role of forests as the primary ecosystem capable of long-term carbon storage. Because carbon dioxide is a major greenhouse gas, plants and especially trees are an important player in the effort to mitigate global warming.

“In the Great Lakes forests, we’re in a very interesting time right now called an ecological transition,” Curtis explains. “Of course we need forests to continue to store carbon, but they are also functioning in another very important way as biodiversity storehouses,” he adds. This function of forests will become more important with climate change as species



Sensors on 150-foot towers above the forest canopy measure the flow of carbon dioxide into and out of the trees at the University of Michigan Biological Station. In Great Lakes forests, carbon flow during photosynthesis and soil respiration results in the net storage of about 0.7 tons of carbon per acre each year.

determine their new place in a changing environment, as the different habitats often present within forests will harbor a lot of biodiversity, and diverse ecosystems tend to deal with change much better than ecosystems dominated by a small number of species.

Curtis’ recommendation based on his findings to date is simple: “When in doubt, don’t cut it. Let the forest age naturally, and it’s not just going to be alright, it’s going to be better.” Considering the many questions people have about earth’s future climate, a simple suggestion like this is sure to be a good start.

To view Curtis’ archived webinar, as well as other webinars on climate change impacts in the Great Lakes region, visit ChangingClimate.osu.edu. The *Global Change, Local Impact* Webinar Series is a multi-departmental effort within Ohio State University, led by OSU Extension, Ohio Sea Grant, and Byrd Polar Research Center, to help localize the climate change issue for Ohioans and Great Lakes residents. **TL**



Peter Curtis is professor of plant ecology at Ohio State University. He conducts research on ecosystem responses to climate change and directs the Northern Forest Carbon Cycle Research Program at the University of Michigan Biological Station. He has published widely on ecological responses to rising atmospheric carbon dioxide, how climate and land use affect forest carbon storage, and the role biological complexity and ecological resilience can play in aiding our future forests.

Science is Best Taught Outdoors

by Matthew Forte, Ohio Sea Grant Communications

Most people don't choose to walk home from school on a snowy 20-degree day, but for Susan Wasmund, it's just another way to be outside, learning about something she may teach one of her students.

Even now, in her 28th year of teaching biology and physical science at Westerville North High School, Susan still loves discovering new things. She began taking classes at Stone Laboratory five years ago and found they were a perfect fit for her. "Stone Lab is a total immersion in science, from breakfast until when the mayflies go to bed at night," she remarks. "Even at mealtime, you continue to learn by bouncing ideas off other teachers and sharing suggestions about what methods work in each other's classrooms."

And it's easy for her to bring back what she learns at Stone Lab and use it in her classroom. Susan has taken three Stone Lab courses, one thanks to a Stone Lab scholarship, and three workshops. "Whatever subject you teach, you will touch on something in your Stone Lab class that carries over to high school curriculum," she says. "My time there gives me ideas to use in class even when I'm not specifically teaching about Lake Erie." A Stone Lab course about teaching with Google Maps changed the way Susan teaches about distance and displacement and an oceanography course helped Susan prepare her Science Olympiad team for competition.

Susan is always looking to share an adventure with someone. She spent this year's Martin Luther King Day holiday weekend at Yellowstone National Park with a group of Westerville North teachers. At Stone Lab she's taken a sport fishing class with her son, ("Yes, I did learn how to filet a fish," she notes proudly), and two other classes with fellow Westerville North teachers. Six current staff members at the school and one of Susan's students have now taken Stone Lab classes.

She takes her students outside to point out things that have been around them all along, but that the students had been too busy to notice. While Susan was teaching a unit on birds, a student told her one Monday morning, "Mrs. Wasmund,

I did nature this weekend. I saw a robin." "A lot of people see robins every day, but for this student, it was a new discovery," Susan says. "If I can make students recognize just a couple things, maybe they'll take the next step to learn more on their own because I encouraged them."

"Stone Lab does that for me—it gives me the chance

to have someone point out something that I hadn't noticed," she says. "And Stone Lab teaches you more examples or ways of explaining—you never know what will help a student learn."

As for braving the cold weather, "It's not too bad if you dress in layers," she advises. **FOSL**



Friends Of Stone Laboratory

Dear friends,

As students of Stone Laboratory, we met many challenges—completing collections, writing papers, making presentations, designing curricula, and investigating biological activities in Lake Erie. The support and assistance of Stone Lab faculty, staff, and fellow students made these challenges easier.

Are you ready for a new challenge?

We need your help! Stone Laboratory received two generous donations, one from the Lonz Family and one from the Beecheler Family. Both donations will support scholarships for students and teachers at Stone Laboratory. The donors have challenged FOSL to double these donations with matching funds.

We are asking for your support to help us match these funds for a total contribution of \$40,000 to the Stone Lab Fund. Our collective contributions will allow Stone Laboratory to provide more scholarships for students and teachers this summer and for years to come. We are already on our way to reaching this matching goal through donations from the Lake Erie Marine Trades Association from Lake Erie Day at the Cleveland Boat Show, contributions generated through the Stone Lab Winter Program and Silent Auction, and gifts from other FOSL friends.

As you make your donation this year, FOSL asks that you consider contributing to this challenge match. You can do this by writing "Lonz and/or Beecheler match" in the memo of your check. With your generosity and support, we can continue the nationally recognized education, research, and outreach initiatives through Stone Laboratory. If you received a Stone Laboratory scholarship in the past, please considering making a donation at this time to "pay it forward" for the next generation of Stone Lab students and teachers.

Thank you for your continued support of Stone Lab!

Sincerely,

Tracey Meilander
FOSL President

broadierimpacts@yahoo.com

A Golden Evening

Who would have guessed that an 1857 shipwreck containing 30,000 pounds of gold would have several links to a former Ohio Sea Grant Director? As the feature presentation of the 13th annual Ohio Sea Grant and Stone Laboratory Winter Program, Dr. Charles Herdendorf told an intriguing story of one of his ancestors who went to California to become a "49er." Historical threads connected the adventurer to the Steamship *Central America*, which sank off the coast of the Carolinas. Dr. Herdendorf later participated on a team that found this shipwreck, recovered gold and artifacts, and made many scientific observations related to the wreck site.



Ohio Sea Grant Director Dr. Jeff Reutter welcomed the nearly 150 attendees and highlighted many of the program's successes of the past season. Particularly exciting were the two recent donations of \$10,000 each to our scholarship funds from the Lonz Foundation and from the Beecheler Family. These donations have created a challenge for FOSL to match and we got off to a good start as proceeds from the night's activities raised more than \$2,750. We wish to thank everyone who donated items for the auction and to the many bidders who made the event such a success. **FOSL**

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With Nature in Mind

The Friends of Stone Laboratory (FOSL) began in 1981 as a support group to “bring Stone Laboratory into the 21st century with the best possible facilities, equipment, and professors, and make this an unequalled learning experience available to all outstanding students.” Members of the Friends provide a way for former students to support the facility by raising awareness and funds for scholarships, research, and equipment.

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FOSL

Mark Your Calendars

Legislative Days on Lake Erie, August 4-5

Ohio Sea Grant and Stone Lab Donor Dinner, August 13

County Commissioner Day, August 18

Interior Transformations

Most faculty, researchers, staff, and guests stay in university housing when they are at Stone Lab. Those with families primarily stay in Peach Point and Sycamore cottages or at the South Bass Island Lighthouse. Because most of the furnishings were worn out broken down, and mismatched, these facilities were more reminiscent of a college-era apartment than housing suitable for guests and their families. FOSL is supporting



Sycamore Cottage

the upgrade of some of these buildings' interiors. Under the coordination of Debbie Hawthorne and Charlene Prochazka, the Lighthouse and Sycamore Cottage have received an initial face lift. The overall efforts have involved lots and lots of shopping at outlet stores, thrift shops, garage sales, and some personal donations. There

have been furniture rearrangements, some new furniture, new bedding, window treatments, and minor construction. The Lighthouse is now much more of a showcase for small group meetings and housing of “VIP” guests. Sycamore is still a work in progress, but has a new efficiency-style apartment in the upstairs. The work will continue in the upcoming seasons in



South Bass Island Lighthouse

Sycamore, Peach Point, Gibraltar House, and Stone Cottage. These renovations, done with volunteer labor and a shoe-string budget from FOSL, have already had a major improvement in the image of Stone Lab's accommodations. **FOSL**



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Crop Yields

If climate change continues as predicted, corn and soybean yields in Great Lake states like Ohio and Indiana could decrease 20-30% by 2049 and 40-60% by 2099.

Ecosystems >

About Us

The OSU Climate Change Outreach Team is a partnership among multiple departments within The Ohio State University. The team's goal is to help localize the climate change issue by bringing related research and resources to residents of Ohio and the Great Lakes region.

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