The Helm

Illinois-Indiana Sea Grant // October 2021

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GREAT LAKES LITTER CONTRIBUTES TO LARGER MICROPLASTIC PROBLEM

Artwork by John Soss

FOR JOHN SOSS, the stuff people leave behind on the beach provides a source of inspiration and fascination. His pastime, and art, is to walk along southern Lake Michigan beaches and arrange the variety of things he picks up along the shore to create photographs.

In his youth, picking up water-worn glass along the Lake Michigan shore was a way to alleviate the doldrums of family beach vacations. In later years, it was Soss' personal project to send daily photos from his walks on the beach to the sister who first inspired his interest. But, as his work has evolved, Soss' photos now have a following on social media and have been on display in a Chicago art gallery with a follow-up show this December.

Still, he continues with his original modus operandi. "The challenge for me is to take what I picked up that day and try to make something out of that without reaching into my boxes and other stuff and trying to make it look prettier," said Soss. "I have to stick with what I found that day."

In his experience, the amount of trash on the beach, in general, is related to storms and wind churning up what's in the water, as well as seasons and holidays when the beach is the go-to spot for socializing.

And while Soss sees the amount of trash as remaining somewhat stable over time, in the last year, unsurprisingly, he has seen more plastic gloves and face masks. "When you introduce a pandemic into the world, what's on the beach changes," he said. "And those are things people throw away. There are those amongst us who think that if you put something into the lake where no one can see it, then it's gone."

LITTERING THE LAKES

While Soss creates appealing images from what he picks up along Chicago area beaches, the larger trash story is not so pretty. Bottles, cans, food packaging, cigarette butts, and the rest do indeed present an eyesore along Great Lakes beaches.

"Debris can not only pose health and safety threats for people, but also for wildlife," said Sarah Zack, Illinois-Indiana Sea Grant (IISG) pollution prevention specialist. "Whether in the water or on shore, animals can get entangled in plastic debris or ingest it, or the clutter can degrade critical habitats."

Plastic poses a major concern—it is just about everywhere in our world. And when plastic products are left in the environment, they eventually break down into their smallest bits, known as microplastics, which endure on land, in the air, and in the Great Lakes and other waters. With funding from IISG, researchers at Loyola University found microplastics throughout Lake Michigan as well as in organisms up and down its food chain.

The microplastics in Lake Michigan come from a number of sources in addition to beach litter, including clothes that shed plastic fibers—for instance, a warm and cozy fleece when it is run through the wash. Plastic pollution is vast and comes in all shapes and sizes.

If we all have some plastic particles in our bodies, what is the impact? For humans, the answers are not yet apparent. However, in a study looking at aquatic organisms, IISG researchers analyzed the body of previous work on this subject and found some negative impacts, particularly on larval fish and zooplankton, which are food for many species. IISG-funded research has also shown that microplastics may increase the risk of aquatic animals ingesting pollutants such as PFAS, which can stick to plastic particles.

SEA GRANT SPREADS THE WORD

IISG strives to address these issues from a variety of angles—from assessing potential impacts to encouraging prevention. In addition to engaging in and funding relevant research, IISG, along with the Illinois Sustainable Technology Center, organizes an annual conference to bring scientists and outreach professionals together to discuss the latest findings related to emerging contaminants and to develop new questions to explore.

IISG has also recently received funding from NOAA to help develop and implement its Great Lakes Marine Debris Action Plan. Zack has helped set objectives and is taking on 10 actions in the 5-year plan that includes the participation of more than 30 organizations.

"Plastic debris is a big problem on Great Lakes shorelines, so we are focusing our messaging on a specific type of widespread debris, like water bottles or plastic bags, which will be selected using social science and

input from the action plan partners," said Zack. "Ultimately, this work will result in a positive call-to-action that will hopefully resonate with the public and reduce the amount of plastic debris found in and around the Great Lakes."

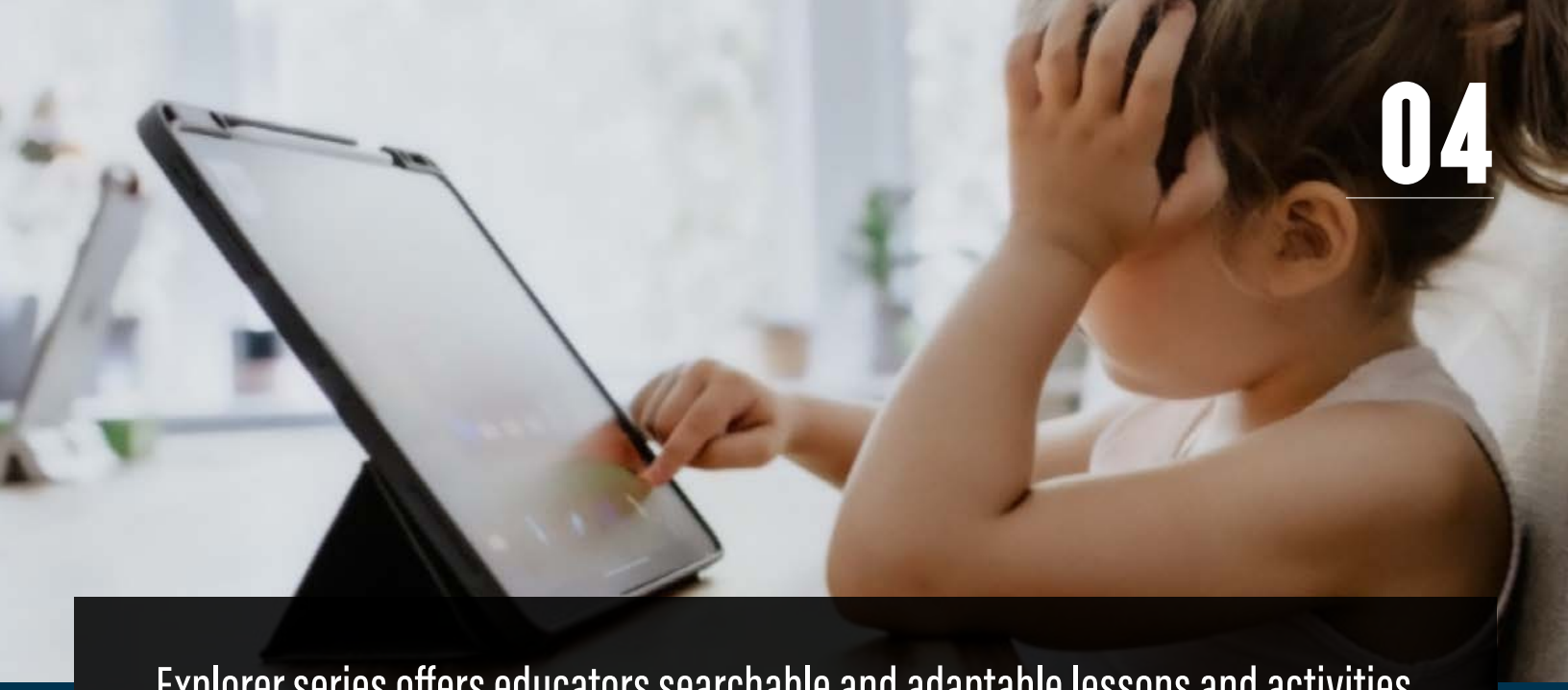
In terms of reaching teachers and students, IISG's new Pollution Prevention Explorer (highlighted on page 04) includes 62 resources on microplastics and marine debris for educators and parents to engage learners of all ages.

As part of an educator workshop series, in 2020, IISG held a session on marine debris for 17 participants. Several teachers immediately took their new knowledge back to their students with one inspiring her class to collect, analyze, and communicate data about the impact of the school's trash production.

In September, Terri Hallesy, IISG educator and student engagement coordinator, joined with the experts from the Friends of the Chicago River and Loyola University Chicago to bring teachers, students, and community leaders together to help clean up the river's edge and learn about the impact of trash.

Sea Grant specialists also engage students directly at events and field trips with the program's activity "How long until it's gone?" In teams, students decide how much time it will take for various items, such as cigarette butts or plastic bottles, to biodegrade in the environment. The answer is mostly way too long.

"We try to make the point that reduce, reuse, recycle is actually the order in which you should be doing these things," said Allison Neubauer, IISG Great Lakes outreach associate. "Recycling should really be the last choice of the three because there's no guarantee something will actually be recycled. And, even if materials are recycled, that ultimately just delays the time before it becomes trash. The best choice is to reduce the number of plastics that you use because they might end up in the environment."



04

Explorer series offers educators searchable and adaptable lessons and activities

While most K-12 classrooms have returned to in-person learning across the country, the pandemic revealed a gap in educational resources that can be easily adapted to virtual or distance learning. To meet this need, Illinois-Indiana Sea Grant specialists have developed education "explorers" focused on weather and climate, pollution prevention, and nutrients.

Each explorer is a one-stop-shop for educators to find classroom resources that can accommodate a variety of learning environments. Teachers or parents educating their children at home can search through the resources using filters to find lessons based on age group, topic, learning mode, and the time it takes to complete each activity.

The Weather and Climate Explorer contains a variety of resources for educators and students to learn about not just weather, climate, and climate change, but other similar topics such as flooding and stormwater, lake levels, and energy and transportation.

"Whether looking for engaging videos, fun activities, datasets to explore, or even standardized lessons, the Weather and Climate Explorer offers a full range of resources to meet classroom needs and may perhaps even inspire students to learn more about what drives our day-to-day weather as well as the changing climate," said Veronica Fall, IISG's climate extension specialist who developed the resource.

The Pollution Prevention Explorer focuses on lessons that help teach students about pollution that affects water resources and how to prevent it. Sarah Zack, IISG's pollution prevention extension specialist, helped build this tool because she wanted students to learn how easy it is to make changes to protect water quality.

"Two of the categories we created in the explorer were 'pollution prevention at home' and 'pollution prevention at school,' and to me those were the most fun because you can find activities you can do at home or at school to actually make changes and have a positive impact on the environment."

While pollution prevention methods can often be fairly easy to understand, the Illinois Nutrient Loss Reduction Strategy (NLRS) is a complex initiative that can be more difficult for students to grasp.

To help break down the impact of human activities on nearby lakes and streams, the Land and Water Nutrient Explorer provides educators with basic, intermediate, and advanced lessons about nutrients, watersheds and the water cycle, stormwater, hypoxia, and more.

The Illinois NLRS is a framework for using science, technology, and industry experience to assess and reduce nutrient loss to Illinois waters and the Gulf of Mexico, thereby reducing hypoxia.

"Illinois is a major contributor of nutrients to the Gulf of Mexico and we can all do our part to be part of the solution," said Eliana Brown, water quality specialist. "Many of the explorer resource links were provided by NLRS partners from agricultural, point source, and stormwater sectors who are making great strides to use best management practices. The intention is that students can learn about what's being done and also about careers in these sectors. In the process they may possibly discover a life's calling."

The explorer increases awareness of practices that help prevent nutrient pollution, including Lawn to Lake natural lawn care.

05

IISG helps aquaculture producers diversify their **marketing opportunities**

Photo (on right) by Hope Charters

AS WITH MANY OTHER BUSINESS OWNERS, aquaculture farmers in Illinois and Indiana faced some setbacks in 2020 due to the pandemic. They typically sell their fish live at East Asian markets and grocery stores. But, as many people hunkered down at home, and restaurants closed, these opportunities dried up.

The aquaculture team set out to help producers diversify their markets by exploring processing their fish.

"I think that COVID was a bit of a wake-up call for aquaculture producers," said Amy Shambach, IISG aquaculture marketing outreach associate. "Without access to processing, these businesses cannot shift quickly to go into another market."

With funding from the National Sea Grant Office to provide rapid response to pressing COVID setbacks, Illinois-Indiana Sea Grant's aquaculture team worked closely with producers to explore possible fish processing sites, provide critical training, and help farmers develop pilot processing plans.

Eleven aquaculture farmers took part in Hazard Analysis Critical Control Point or HACCP training—an internationally recognized food safety system. Working closely with New York Sea Grant, what is typically an in-person training, switched to online. Thus far, as a result of this work, several farmers have expanded their markets and plans for the future.

At Koss Family Farms in White Heath, Illinois, the focus is on aquaponics, a production process that combines aquaculture and hydroponics to grow both fish and plants, such as lettuce or herbs. The business, which was just getting off the ground last year, includes a processing kitchen, but without having gone through food safety training, tilapia sales would be limited to the family.

> "Without access to processing, these businesses cannot shift quickly to go into another market."

When COVID-19 hit, as restaurants and institutions closed down, the lettuce market, which the family was counting on, all but disappeared.

"The HACCP certification allowed us to go forward and sell our tilapia, whether it's wholesale to grocery stores or restaurants, or direct sales to the public," said Mindy Romano, a family partner. And developing a processing plan through the IISG project was cost saving.

Without having on-site or even in-state processing, Mike Searcy, the owner of White Creek Farms of Indiana, LCC in Seymour, got creative. The HACCP training and pilot production plan guidance through Sea Grant paved the way for him to sell his fish to a local restaurant, process it right there, and at the same time, train the kitchen staff to safely filet fish.

He also has expanded his products to include smoked filets.

For the most part, Searcy has sold his fish wholesale and hasn't been dependent on processing, but as he grows his business, that will change.

Steve Koss, of Koss Family Farms, holds a package of tilapia filets processed on his farm.

"I have a processing facility that's been about 90% completed for several years but taking that next step—the HACCP training—was one thing we needed to help push us to our goal" he said. "Hopefully within the next 12 months, we'll be operating our own processing facility."

He also views the aquaculture business in big picture terms.

"My interest is in developing processing in Indiana—aquaculture is going to be somewhat stagnant in the state until we can get some type of processing for small startups to take advantage of," said Searcy.

The IISG aquaculture team describes the goal of the pilot processing project as creating a road map for farmers who are interested in selling processed food to local restaurants or grocery stores.

"It has also provided some insights into what is needed in addition to the training to develop your own products and also develop markets," said Kwamena Quagrainie, IISG aquaculture marketing specialist.

For some, it is just the first step in diversifying their markets.

"When aquaculture producers have challenges with marketing their product to one outlet, if they have at least explored other channels, they know what they entail," said Quagrainie. "Even those that are not getting into processing for now, the HACCP training has helped prepare them, if later they decide to explore it further."

With additional funding, this project is expanding to other Midwest states, including Ohio, Michigan, Wisconsin, Iowa, and Minnesota where opportunities for fish processing in restaurants and institutions will be explored.

Charter boat operators updated with critical COVID-19 information

Photo by Irene Miles

IN 2020, the COVID-19 pandemic significantly impacted charter fishing operators. Many of these businesses were forced to close or suspend operations just as the Lake Michigan fishing season was starting. Also, they were not eligible for many financial assistance programs and lacked clear guidelines to reopen safely.

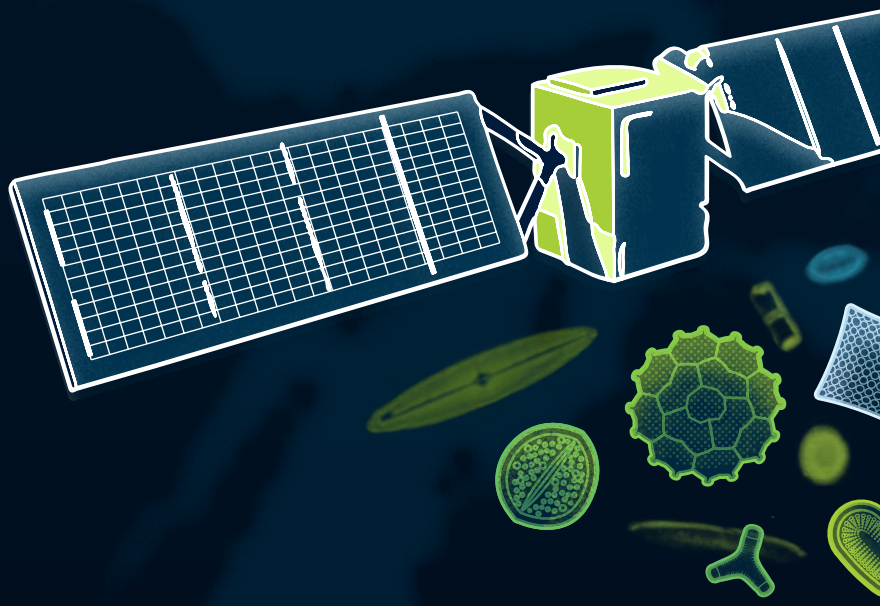
IISG built a network of 129 charter boat operators and business owners registered in Illinois and Indiana, providing them regular updates during the peak of the pandemic. Mitch Zischke, IISG fisheries specialist, produced and distributed publications on potential financial assistance and best practices for reopening safely.

IISG also collaborated with other Lake Michigan Sea Grant programs to survey charter fishing businesses to assess the impacts of COVID-19. The Lake Michigan survey revealed that 37% of charter boat operators ceased fishing in 2020. On average, operators cancelled 26 trips and saw a $17,000 decrease in sales in the early part of the season. More than 40% of respondents feared going out of business in the next 6–12 months.

MASTER'S STUDENTS' RESEARCH HIGHLIGHTS LAKE MICHIGAN

Illustrations by Joel Davenport

ISG FUNDS SCIENTISTS with a range of experience—from those with years of journal articles under their belt to others who are just getting their research career started. With Sea Grant funding, these early-career scientists have an opportunity to develop their investigative skills, enhance their understanding of Great Lakes issues, and play a role in finding solutions. Here are four Master's degree projects from students at Purdue University and Purdue Northwest.



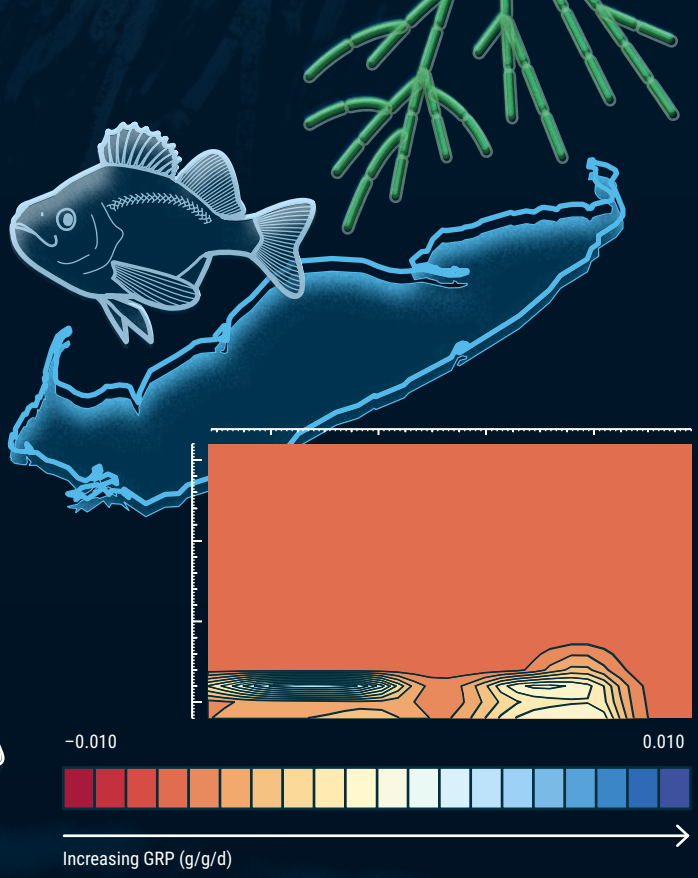
Validating eDNA metabarcoding to assess Lake Michigan fish

ENVIRONMENTAL DNA (eDNA) is detected in traces of shed skin, hair, mucus and waste, for example, that an organism leaves behind in water, sediment, or air. Environmental DNA sampling has been used in lakes and rivers to check for the presence of a species as well as how many species are found in the waterway. **SAMANTHA JURECKI** validated the use of eDNA metabarcoding to assess fish communities in Lake Michigan. Her results were comparable to those obtained through traditional surveys such as electrofishing and seining. The eDNA metabarcoding approach accurately reflected the historical record, which had taken several years to establish.

Using satellite images to monitor Lake Michigan's chlorophyll

SINCE THE ARRIVAL OF INVASIVE zebra and quagga mussels, the food web in Lake Michigan has undergone immense changes in a short period of time, from bottom to top. To assess these changes, scientists use several indicators, including chlorophyll, a green pigment found in plant and algae cells.

MARGARET STADIG used an innovative approach to assess the status of chlorophyll in lakes Michigan and Huron. She studied a longtime series of satellite images of the lakes using an algorithm based on Great Lakes National Program Office (GLNPO) data that analyzes colors and pixels to measure changing chlorophyll concentrations and distribution. The study revealed that surface chlorophyll remained relatively high in Lake Michigan's nearshore waters, but decreased dramatically in offshore waters.



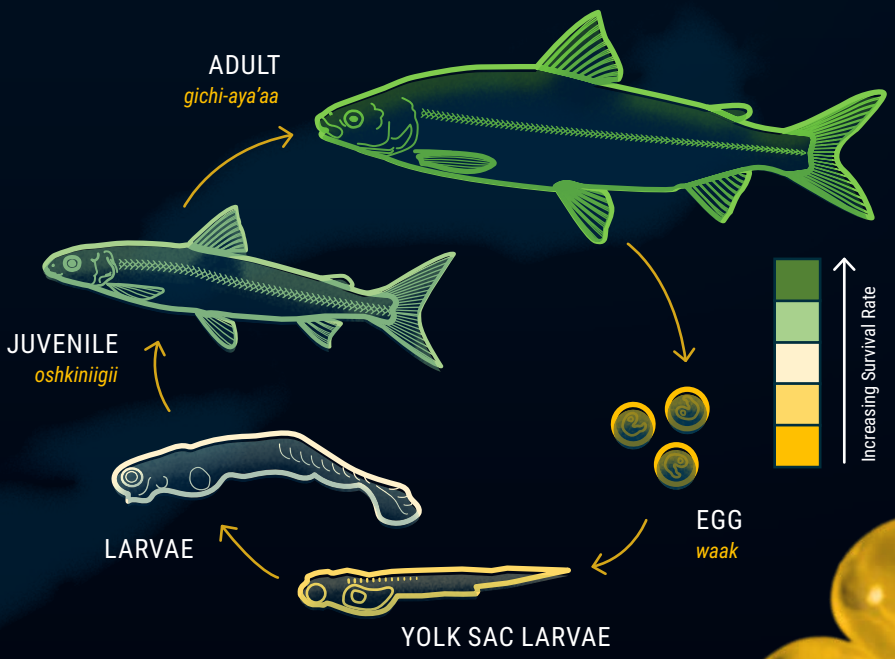
Modeling Lake Erie hypoxia and its impact on fish habitat

EVERY SUMMER, Lake Erie's central basin develops a dead zone, where oxygen is too low for most aquatic life to survive, but the size and distribution of that zone vary from year to year. This hypoxia can develop when phosphorus, often from nearby farm fields or industry, drains into local waters, leading to rapid growth of algae. As these organisms die off, they sink to the bottom and decompose, a process that uses up much of the available oxygen.

JOSH TELLIER was part of a team that developed a 3-dimensional model to map out low oxygen areas in Lake Erie. He used nearly 25 years of data from GLNPO and the U.S. Geological Survey that measured dissolved oxygen levels and temperatures throughout the lake's central basin. The modeling also quantified habitat quality for rainbow smelt, round goby, and yellow perch over time, reflecting hypoxia's impact on the suitability of the environment for these species.

Analyzing Lake Michigan larval fish data

AT THE START OF 2020, indigenous groups and state and federal agencies were coordinating spring larval fish sampling efforts in Lake Michigan, but as the pandemic set in, many field research activities were put on hold. **MARISSA CUBBAGE**, who was set to sample the larvae of coregonid, a group of fish that include lake whitefish and cisco species, in Lake Michigan's Green Bay, pivoted to processing samples collected in previous years. Little Traverse Bay Band of Odawa Indians biologists lent Cubbage the coregonid samples collected every spring since 2015. The cultural relationship between the Little Traverse Bay Band of Odawa Indians and coregonid is a longstanding one that includes subsistence and commercial fishing. Cubbage analyzed larvae abundance and diet factors and is sharing her findings with the Traverse Bay Band.



09

PURDUE RAINSCAPING PROGRAM *brings rain garden training to* ILLINOIS EXTENSION

For community leaders and homeowners looking for ways to reduce the threat of flooding, especially in the face of bigger storms due to climate change, rain gardens can be part of the solution. Good news for these folks and others in Illinois—the Purdue Extension Rainscaping Education program has expanded its reach and is now a University of Illinois Extension program, too.

Rainscaping incorporates sustainability into landscape design. The focus is installing and maintaining rain gardens and other green infrastructure to manage stormwater, which can run off pavement and other hard surfaces, picking up contaminants and flowing into nearby waterways. The plants and soil in a rain garden absorb stormwater where it falls.

The Rainscaping Education program provides training and resources for practices that can be installed in residential settings or small-scale public spaces. Workshops throughout Indiana have been attended by representatives from organizations and agencies, including stormwater utilities, soil and water conservation districts, and relevant non-profits, plus Master Gardeners and landscape contractors.

"This program is a very accessible way to train large groups of people on how to appropriately site, size, install, and maintain rain gardens," said Kara Salazar, Illinois-Indiana Sea Grant and Purdue Extension assistant program leader, extension specialist for sustainable communities, and Purdue Rainscaping Education program coordinator.

At the end of the 15-hour workshop, participants get their hands in the dirt to plant a demonstration rain garden in a public location.

As with most educational opportunities, the workshops became totally virtual in 2020 and the planting of demonstration gardens as a group was suspended. More recently, the workshops have been presented with much of the training online that culminates in planting the rain gardens in person again.

"Through planting these gardens, participants gain real-world experience," said Salazar. "They can go back to their communities and be rain garden ambassadors—bringing knowledge of the benefits of rain gardens as well as how to create them. Through this process, we are developing community networks."

The 10 demonstration rain gardens planted in Indiana have reduced stormwater runoff by nearly 410,000 gallons each year. Rain gardens installed by participants or their partners back in their communities reduce runoff even more. In addition to reducing the risk of flooding, these gardens can improve water quality.

Photo by Ciara Nixon, Greater Egypt Regional Planning and Development Commission

Rainscaping participants in Jackson County in Illinois came together to improve an existing rain garden as part of the program's hands-on training.

Illinois-Indiana Sea Grant led the process to bring the rainscaping program to Illinois. The first Illinois Extension training sessions in the state kicked off this year in May in Jackson County, with two more workshops in September in Effingham and Champaign counties.

"It's exciting that in a few years, like Purdue, we're going to have demonstration gardens all over the state," said Eliana Brown, IISG stormwater specialist and Illinois Rainscaping Education program coordinator. "As knowledge grows with every installation in both states, we can all help each other have successful rain gardens."

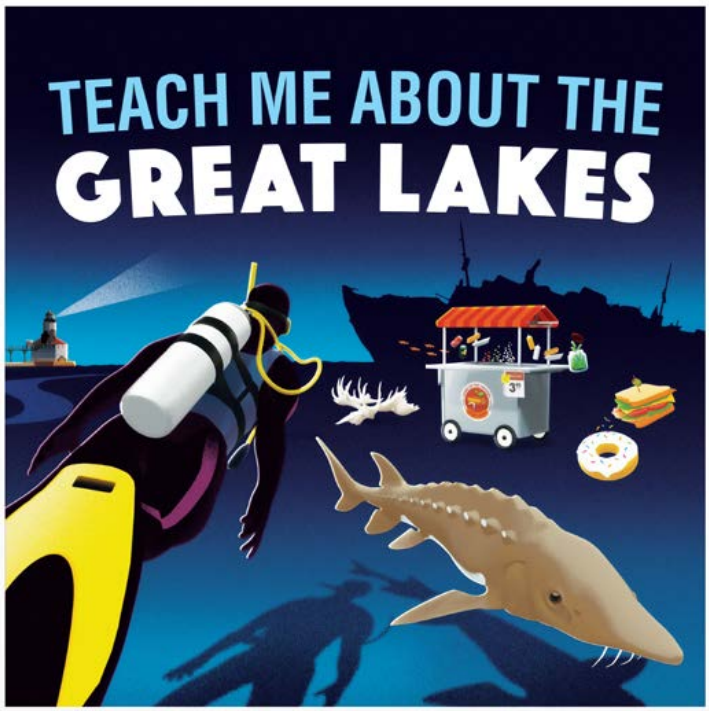
"Many Master Gardeners, consultants, and agency folks now have rainscaping expertise and are teaching others or using this knowledge for their own green infrastructure projects," said Salazar. "One community, in particular, has their own rainscaping group, so they're going out talking to people about rain gardens."

Brown thinks of rain gardens as having the capacity of being beautiful and functional, but also inspirational.

"A rain garden is something that, on a homeowner scale, is achievable—it's an action that a person can do to be responsible for the water that's shedding from their roof and other impermeable surfaces. If your neighbors are inspired to install rain gardens, we then have them working at the neighborhood scale. Then you're really making a difference."

For more information about the Rainscaping Education program, visit the program website.

https://extension.purdue.edu/rainscaping/



teachmeaboutthegreatlakes.com

Podcast series enhances Great Lakes literacy in the region and in the classroom

Illustration by Joel Davenport

IISG continues its fun and educational podcast, called "Teach Me About the Great Lakes," to help residents, decision makers, and others learn about the Great Lakes from as many angles as possible. The premise of the podcast is that IISG's Assistant Director Stuart Carlton is new to the region and has much to learn about these waterbodies, so in this podcast, he is joined by a range of experts who teach him (and listeners) about the Great Lakes.

In 2020, IISG released 21 podcasts, including several live episodes, covering a broad range of topics such as aquatic invasive species, lake levels, bird ecology, water quality, water safety, fisheries, and even Great Lakes regional politics. The podcast has been downloaded more that 5,000 times, and the series made its way into a West Lafayette, Indiana high school. About 50 students listened to a podcast every Friday for a semester and created visual summaries as part of their Great Lakes learning.

Lake Michigan water level variability workshop highlights needed resources

Photo by Irene Miles

Record high water levels on Lake Michigan and other Great Lakes in 2020 caused widespread impacts—from erosion to flooding. But these record highs followed historic low water levels less than a decade ago, illustrating the types of weather and climate variability that are anticipated as the climate continues to change.

IISG hosted a virtual workshop series to address these concerns, bringing together natural resource managers, experts, scientists, and community leaders. The four workshops were attended by 30-40 participants each day, bringing their unique expertise and background to share. More than 25 information gaps and needs were identified and ranked by the participants. This priority list will guide IISG Climate Extension Specialist Veronica Fall's work on lake level impacts around southwestern Lake Michigan. The list has also proved useful to several partners and participants in reevaluating how they move forward on projects related to Lake Michigan water levels.

The Helm

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Quick Splashes

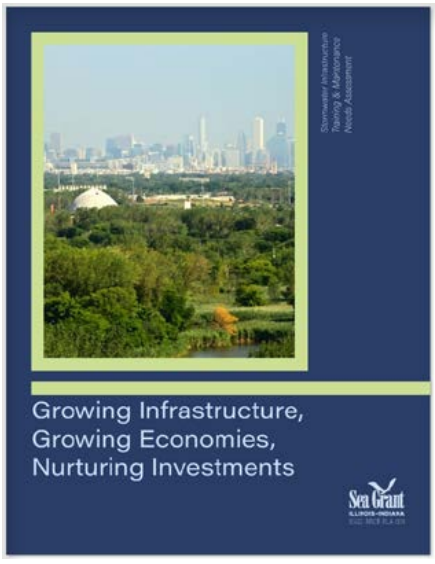
Local Fish, Local Flavors: Baked Trout

When you buy local seafood, you are using the influence of your purchases to support sustainable industries in your community. To inspire you, Amy Shambach, IISG aquaculture extension outreach associate, shows us how fast and easy it is bake trout. Find more recipes and cooking demonstrations at EatMidwestFish.org.

https://eatmidwestfish.org/recipes/cooking-demos/

Growing Infrastructure, Growing Economies, Nurturing Investments

Green infrastructure can reduce local flooding and protect water quality, but for rain gardens to do their job they need to be properly maintained. To assist green infrastructure project managers, IISG engaged in a needs assessment of landscape industry standards, including job training skills.



https://iiseagrant.org/publications/growing-infrastructure-growing-economies-nurturing-investments/

Lawn to Lake Midwest Website

Natural lawn care uses an approach that works with nature to grow a healthy landscape and protect water resources. You don't have to get rid of all your grass or dedicate your life to tending your lawn. It depends on a simple principle: that a healthy lawn will be able to resist most weeds, disease, and insects.

https://lawntolakemidwest.org/