The Helm

Illinois-Indiana Sea Grant // October 2023



Green infrastructure helps communitieslarge and small—be ready for the future



With a Hydrolab, student scientists



Study finds PFAS in all tested Lake Michigan sportfish and their prey

Aquaponics offers high schoolers a hands-on way to learn science, math, and more



Log into quick fish consumption safety and nutrition info

Great Lakes AOC project team awarded for outreach efforts



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Green infrastructure helps communities—large and small—be ready for the future

Conserving or growing the number of trees and other plants in our environment is not just a feel-good idea. Among many benefits, gardens and other greenspace can help reduce flooding, a major concern in the Midwest due to increasingly larger, more frequent storms, as well as expanding development that leaves rain nowhere to go.

Green infrastructure, such as rain gardens, allows rainwater to be absorbed where it lands.

Hazard Mitigation Planning

TO PROVIDE ON-THE-GROUND SUPPORT for incorporating green infrastructure, Illinois-Indiana Sea Grant (IISG) and Purdue University and University of Illinois Extension programs are helping inform the process as communities develop or update their Multi-Hazard Mitigation Plans or other resilience plans.

"This effort arose out of working with community groups and hearing that they have a need for these resources," said Kara Salazar, IISG sustainable communities extension specialist, who led this work.

With funding from the Extension Disaster Education Network, the team developed a planning process that brings together existing plans and ordinances, GIS data, and input from focus groups and community engagement. In two communities, the project team and local participants worked together to identify current and future strengths, assets, and opportunities as they relate to natural hazards faced by the community, with an emphasis on nature-based solutions. The team also used the new Green Infrastructure Optimization Tool, which, through visualizations, can help decision makers determine suitable placements for rain gardens and other nature-based options.

"It's important that green infrastructure is located where it will be most effective and have the most impact," said Salazar.

In an Indiana county that sits along Lake Michigan, the City of La Porte requested help from IISG as it set out to improve its stormwater management plan. In addition to two planning sessions, local stakeholders took part in the Rainscaping Education Program, which culminated in the installation of a demonstration rain garden in an underused park adjacent to city hall.

"The garden installation was part of a larger effort to build resilience in La Porte through updating ordinances and installing green infrastructure," said Salazar. "The rain garden site absorbs a significant amount of stormwater runoff. It is part of a suite In La Porte, Indiana, a recently planted rain garden near city hall helps improve stormwater management in the downtown area.

of green infrastructure practices installed throughout the city, including along a state highway redevelopment corridor."

In Hancock County in Illinois, it was time to update the Multi-Hazard Mitigation Plan and the green infrastructure team was there to help the county and its municipalities explore possible nature-based solutions. This very rural county, with a total population that is less than the city of LaPorte, has limited resources to invest in infrastructure, green or otherwise.

Nonetheless, local decision makers see the writing on the wall.

"With a changing climate, the expectation is that major storms will be more frequent," said Carolinn McKillip, Illinois Extension community and economic development educator. "Many communities that don't have storm sewers to accommodate this much rain are looking to new construction as a way to incorporate nature-based solutions."

As a result of IISG and Extension's efforts in Hancock County, in several municipalities, the hazard plan includes creating policies and procedures to incorporate green infrastructure into future development. In fact, a project in Carthage is underway to build a new library and if funding is found, it will include a rain garden.

In nearby Nauvoo, local leaders, master gardeners, and other stakeholders took part

in Rainscaping training and planted a rain garden of more than 1,500 square feet that runs along both sides of a highly traveled intersection.

Additionally, the City of La Harpe has several green infrastructure projects included in its hazard mitigation plan, again, if the city can secure funding. Local planners are also looking to transform abandoned land into something useful.

"They will explore using some vacant lots to reduce stormwater on La Harpe's main streets downtown. Planners are talking about rain gardens, terracing, or permeable pavers and creating something like a pocket park," said McKillip.

The work of Salazar, McKillip, and their team in the two states has led to the development of a <u>toolkit</u> that is a resource for communities in the Great Lakes region and beyond. With facilitation from Sea Grant or Extension, communities can access the agendas, activities, and presentations that provide guidance in incorporating green infrastructure as part of hazard mitigation planning.

"This summer's weather should tell us that that we need to rethink the way we do things," added McKillip. "Hopefully, efforts like this can help expand the knowledge base to everyone in our states and our communities on how to be more resilient to these extreme weather events that we're facing."



At the Smrt Community Center in Michigan City, Indiana, IISG's Kara Salazar helps with the installation of a new rain garden.



One Block at a Time

FLOODING AND OTHER CLIMATE CHANGE IMPACTS are the drivers of another community outreach project—for this one, IISG is collaborating with both Minnesota and Pennsylvania Sea Grant programs. With funding from the National Sea Grant Office, they formed a multi-community work team to address climate hazards in Michigan City and Hammond, Indiana; Duluth, Minnesota; and Erie, Pennsylvania, respectively.

"Communities or neighborhoods that are marginalized due to income insecurities and other social vulnerabilities are acutely experiencing multiple water-related climate challenges yet have the fewest means to respond," said Salazar.

As part of this project, Minnesota Sea Grant developed the Ready for Rain One Block concept (adapted from the Center for Neighborhood Technology) to engage local government and residents in addressing the challenge of flooding. The idea is to develop community-planned green infrastructure projects in one city block, which can be duplicated across nearby blocks.

In Indiana, IISG collaborated with the Smrt Community Center in Michigan City and the InnerMission Neighborhood Farm, managed by the Gate Church, in Hammond. Both sites have small community gardens, developed with help from Purdue Extension, to increase access to fresh vegetables for neighborhood residents. But at both sites, a sustainable water source was a challenge. "At each location, we worked with the garden managers, neighbors, and site users to conduct focus groups, interviews, and site visits to collaboratively design a rainwater harvesting structure and a rain garden to catch any overflow," said Salazar.

At the community garden site in Hammond, this year, instead of dragging five-gallon buckets of water to the garden, volunteers are able to fill up a watering can on site or use the garden hose to keep tomatoes, cabbages, collard greens, peppers, cilantro, and other produce plants properly watered. Nearby residents are welcome to take produce as needed and some are chipping in to help with weeding and other tasks.

The site has grown with the addition of a micro food pantry and a meditation labyrinth. Angelica Weaver, who founded the garden, is planning on adding a little free library and places for children to play.

"The work of Purdue Extension and Sea Grant has helped us become sustainable, which was a dream of ours since we started this project in 2020," said Weaver. "Now we feel like we have the tools to continue the work that we're doing for many years to come."

One Block at a Time efforts in Indiana, Minnesota, and Pennsylvania have also been compiled into a soon-to-bereleased toolkit for broader use. This collection of resources takes one through the process, including background assessments as well as community visioning, scoping, and implementation.



Angelica Weaver (also on the cover) who manages the InnerMission Community Farm community garden in Hammond, Indiana, now can rely on a dependable onsite water source.

Environmental Justice Communities

SMALL, RURAL COMMUNITIES that have suffered from industrial pollution or other environmental or economic setbacks will soon have some support to make things better. Through a nationwide Environmental Protection Agency (EPA) grant, IISG will provide technical assistance to help underserved Indiana communities define and implement their visions.

"We will especially be connecting with communities that have difficulties applying for federal grants because of their size and limited staff support," said Salazar. The focus will be on funding opportunities available from EPA and the Department of Energy.

Salazar and her team will engage in outreach that will likely take the form of workshops. "The focus may include grant writing, grant management or facilitation work, and other skills that can help communities successfully fund their impactful environmental projects."

The work in Indiana will be part of a larger grant that includes Illinois and other EPA Region 5 states and tribes. ♥

https://sites.google.com/view/community-planning-toolkit/



New webtool helps 'ground' green infrastructure



REEN INFRASTRUCTURE CAN REDUCE FLOODING, but it doesn't always work as well as it might. However, taking soil type and other onsite factors into account in the design of a rain garden or other green infrastructure can increase the effectiveness of these efforts. Soil characteristics, for example, can indicate how much and how fast water can be absorbed into the ground and move through plant roots.

Illinois-Indiana Sea Grant and the University of Illinois have developed <u>Illinois Groundwork</u>, a webtool based on multidisciplinary research that included an extension process piloted in two Chicago suburbs. Groundwork provides green infrastructure research, tools, and resources for stormwater professionals, local leaders, and community members.

Illinois Groundwork contains a bounty of resources including a step-by-step guide for integrating soils information into design and planning and an interactive tool to help estimate the most effective size for green infrastructure. Other resources include lists of relevant regulations and needed expertise, realworld green infrastructure examples, and Plant Finder, which helps designers select vegetation best suited for site conditions. ♥

WITH A HYDROLAB, STUDENT SCIENTISTS STUDY THEIR OWN ENVIRONMENT

OR A WHILE NOW, John Gensic, a high school biology teacher in Mishawaka, Indiana, has been redirecting his teaching from a focus on classroom lectures to having students participate and be actively engaged as scientists. One key way he is achieving that is by putting a Hydrolab in his students' hands.

Hydrolabs are sensor units that are used by scientists to monitor water quality and have been available for educators to borrow through Illinois-Indiana Sea Grant and the Environmental Protection Agency's <u>Limno Loan</u> program since 2011. So far, 83 educators, many coming back for multiple years, have engaged nearly 13,800 students in collecting and analyzing data from nearby lakes, creeks, and rivers.

As a result, many of these educators have reported more time spent with their students on aquatic sciences up to 2.5 weeks. They also report that students are more engaged because the data is relevant and real to them, plus they are learning valuable skills and feeling like real scientists.

In an example of an empowered young scientist, a Crown Point, Indiana high school student's experience and initiative with a Hydrolab led her to an independent study project. When she graduated to Purdue University, the student brought this project with her; with help from her high school biology teacher, Ashley Cosme, the student developed and presented a poster about this project at the Hoosier Science and Engineering Fair and wrote an article that was published in Purdue's undergraduate research journal.

Many educators that borrow a Hydrolab were introduced to the equipment while participating in the Shipboard Science Workshop, where educators spend a week on one of the Great Lakes working side by side with scientists, helping with research projects aboard the Environmental Protection Agency research vessel, the Lake Guardian.

Gensic (pictured along with his students on following page) has taken part in the Limno Loan program since 2015 after his experience with the Lake Michigan teacher workshop, and his students now have years of data from the nearby St. Joseph River. In 2022, however, he stopped borrowing the equipment because he secured grant funding to buy a Hydrolab for Penn High School.

"Because we have our own Hydrolab, we are not limited to the loan period and whatever weather or circumstance that happens during that two-week time," said Gensic. "It's been a great catalyst to do a variety of field work. I'm able to take my students out more frequently and other science teachers can do the same. The number of students who have been impacted by the increased access is probably fivefold from what it was before."

In fact, in 2022, Gensic's 100 biology students used the Hydrolab to monitor the St. Joseph River as many as 14 times. Four other science teachers used the Hydrolab to connect approximately 475 more students to real world assignments.

Gensic attributes the shipboard workshop and the Hydrolab as re-energizing his career as a teacher, helping him continue to learn and grow and fully engage his students. And when his students get out in the field to monitor local waters, "they can get a deeper sense of where they're at in our watershed, a deeper sense of the connection between what they're learning in class and what's just outside the door of our school, and they get a fun day outside," he said. ♥

https://limnoloan.org/



Study finds PFAS in all tested Lake Michigan sportfish and their prey

HEN IT COMES TO PFAS, scientists have found these "forever chemicals" in soil, water and air in sites around the country and the world. Now, researchers have found PFAS in every Lake Michigan fish they sampled and a particularly toxic form of PFAS in most of the lake's sportfish.

PFAS is short for per- and polyfluoroalkyl substances, which encompass thousands of compounds that don't break down in the environment. They are used in many everyday items like nonstick cookware, water- or stain-resistant clothing or carpeting, cosmetics, and even toilet paper.

Along with their persistence and growing presence in the environment, these chemicals may have human health impacts, such as impairing one's immune system, increasing the risk of some cancers, and delaying development in children.

With funding from IISG, scientists from the University of Notre Dame led by biologist Gary Lamberti and nuclear physicist Graham Peaslee—set out to assess the presence of PFAS in Lake Michigan fish and how these chemicals move through the lake's food web, which had not been previously studied.

"We tested over 100 sportfish—chinook salmon, coho salmon, rainbow trout and native lake trout—and another 100 or so prey fish from all four quadrants of Lake Michigan," said <u>Daniele De</u> <u>Almeida Miranda</u>, a postdoctoral associate working on the project. They found PFAS in all sampled fish, both predator and prey, and in similar amounts and composition throughout the lake. The good news in terms of Lake Michigan—the study showed PFAS levels were lower than levels detected in most other Great Lakes.

Of notable concern though, was the widespread presence and level of PFOS (or perfluorooctane sulfonic acid) in the lake's fish. These compounds were identified in more than 95% of sampled fish, especially salmon and trout.

"PFOS are a type of PFAS that are very toxic, even in low concentrations," said Miranda. "For that reason, these compounds were phased out of production in 2002. Over 20 years later, PFOS are still the main PFAS compounds that we are seeing in Lake Michigan fish."

These dangerous substances were also more likely than other tested PFAS compounds to bioaccumulate, meaning to move up the food chain from smaller to larger fish, potentially resulting in higher concentrations in popular sportfish.

"While bioaccumulation is straightforward with some contaminants, such as PCBs or heavy metals, it's not with PFAS," said Miranda. "For some PFAS compounds we found higher levels in predator fish such as chinook and lake trout, than in prey fish, but sometimes it was more variable."

Lamberti noted that PFAS uptake by fish can be complicated, and many





factors might play a role, such as the smaller fish's diet or whether they spend time near the lake's sediments, where PFAS might accumulate. "For example, small bottom-dwelling fish called sculpin had the highest PFAS concentrations of all the fish tested," he said.

Also part of this IISG project, Peaslee developed a quick and affordable screening tool using technology that involves particle induced gamma-ray emission (PIGE) for analyzing PFAS and the researchers adapted the process for sampling fish tissues. This new approach provides a measure of total fluorine levels, which are a useful indicator of the presence and the amount of PFAS in fish.

The PIGE method was tested using a subset of this project's sample fish and next steps include expanding that number.

The research team expects this first look at PFAS and their movement through the Lake Michigan food web to help decision makers evaluate the extent of these pollutants in the ecosystem and in sport fish, which may ultimately be on someone's dinner plate.

This study is published in the journal <u>Science of the Total Environment</u>.

Should I eat fish caught from Lake Michigan?

Ilinois-Indiana Sea Grant also supported research to assess just how much we still need to learn about PFAS and their chemical relatives PFOS and PFOAs. A series of discussions with scientists and other experts highlighted that PFAS levels in fish are highly variable, changing with place, time, and species; fish consumption is one of many significant ways to be exposed to PFAS, and may not be the most important one in all communities; and more research to better understand PFAS and fish consumption is underway. Stay tuned for the latest information. ♥

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Tracking Fish in Chicago's Loop



LLINOIS-INDIANA SEA GRANT, Shedd Aquarium, and Purdue University are studying fish behavior in the downtown waters of the Chicago River. Like many of the world's urban rivers, the Chicago River has been channelized, straightened, deepened, and tied to the city's sewer system.

This summer, researchers began their Chicago River Acoustic Telemetry Array project by equipping 80 fish, including largemouth bass, common carp, and bluegill with acoustic tags. Receivers in the water listen for nearby tagged fish and store the tag ID as well as the date and time.

Fish tracking can help researchers understand how fish are using certain restoration initiatives, such as artificial floating islands, as well as identify critical spawning habitat, key overwinter areas, movement patterns, and home ranges. ♥ At the Chicago High School for Agricultural Sciences, the new Urban Agriculture Laboratory, which provides the site for the school's aquaponics system, has a grand opening celebration.

AQUAPONICS OFFERS HIGH SCHOOLERS A HANDS-ON WAY TO LEARN SCIENCE, MATH, AND MORE

HEN BECKY AND JOHN Waterman decided to donate their aquaponics equipment, they made it their mission to have the most impact and they focused on education. Becky contacted Purdue University and spoke with Andrew Coursey, IISG aquaculture specialist, and an idea was hatched to introduce hands-on aquaponics to interested high schools in Illinois and Indiana.

Through aquaponics, students can learn how to raise and harvest fish and other seafood as well as plants. In this closed system the nutrition in fish waste feeds plants grown hydroponically. The cleaned-up water is then returned to the fish environment.

"Agriculture is expanding and evolving beyond rural farm fields to include controlled indoor environments," said Coursey. "The more students learn about growing fish or plants for food this way, the better off they will be—they will understand what food systems in the future will be like as well as available jobs."

Coursey divided the Waterman's equipment among a few participating schools and helped them get their systems up and running. Paying for the equipment as well as its installation is challenging for schools so when Coursey was able to design and build a system with the donated equipment, it made the difference.

At this point there are six high schools raising fish and, in some cases, plants too, in classrooms, greenhouses, or other school spaces; equipment sources have grown to include many aquaculture producers in the two states donating what they no longer need.

"Some schools have koi, a very hardy fish, because they want to keep them long term, others grow tilapia because they want to sell their fish at the end of the project to raise money, typically for school programs," said Coursey. "In terms of plants, sweet basil works really well because it handles a range of temperatures. Lettuce and other produce need more temperature control, which can be difficult in a high school setting."

It's useful for students to learn about these growing systems, but aquaponics also offers a hands-on way to learn STEAM—science, technology, engineering, agriculture, and math. To that end, Andy led the development of a curriculum.

The curriculum is 10 lesson plans that comprehensively cover aquaponics, but it is designed so that an educator can pull out a single component to reinforce classwork while connecting to the school's aquaponic activities, although not necessarily.

"For example, these growing systems provide a really good avenue to learn about water quality and the nitrogen cycle," said Coursey. "The curriculum illustrates that the nitrogen cycle is important in aquaponics and that it also applies to the natural environment and in fact, how the nitrogen cycle works as a whole planet lifecycle." One of the schools that took part in the initial distribution of donated equipment was the Chicago High School for Agricultural Sciences (CHSAS) on the city's far southwest side. The school's involvement in aquaponics has grown over the years and now it is a key component of its new Urban Agriculture Laboratory. With a \$25,000 grant, CHSAS rebuilt and upgraded its aquaponics system with help—on many fronts—from Coursey.

"He was the master builder, he planned the plumbing system, and he helped us develop a weekly maintenance plan," said Noelle Coronado, lead agriculture teacher. "Plus, Andrew provided orientation and training for the new system."

The school presented Coursey with an Outstanding Partner Award last spring as part of celebrating the opening of the lab.

Managing the aquaponics system will be a focus of a new urban ag course, which will take place right next door to the lab. In addition, several other teachers have incorporated aquaponics curriculum units into their course curricula.

This school year will be the first real test of the new lab with everything in place. The plan is to raise tilapia and perch, and plants such as lettuce, and maybe tomatoes and zucchini.

"If our timeline works, we'd like to have fish fries in the spring, possibly a senior fish fry," said Coronado. "The lettuce

might be available weekly for now, the process will be on a trial-and-error basis." Any funds raised would support the aquaponics program.

While IISG's work with schools will continue, Coursey is finishing up his last weeks with the program—he has moved to Missouri and new opportunities. He sees his time introducing aquaponics to high school students as very rewarding.

"I grew up fishing—I learned a lot about fish from catching them, from having hands-on access," he said. "In large metropolitan areas, the kids really don't have that. To see students light up just interacting with the animals, feeding fish, working directly with plants, that's where I see the real benefit. The students really love it and I see them directly connect to what I'm teaching them." ♥

IISG's Andrew Coursey demonstrates that, in an aquaponics system, basil seedlings grow in water that recirculates from fish tanks.



Log into quick fish consumption safety and nutrition info

avigating the dos and don'ts of seafood consumption during pregnancy and breastfeeding can be challenging. On one hand, the omega-3 fatty acids found in seafood are vital for the brain and eye development of fetuses, infants and children. On the other hand, certain contaminants like mercury and PCBs can pose risks.

The <u>Fish for Your Health[™]</u> website provide science-based seafood consumption advice to help consumers make educated dietary decisions. "We are really excited about the Find the Best Fish for You page that people can pull up on their phones and search quickly when at a restaurant or grocery store," said Amy Shambach, IISG aquaculture marketing outreach associate. The updated website now offers a searchable list of seafood choices categorized as best choice, low mercury, moderate mercury, and do not eat. Additionally, printable cards are available in English and Spanish, presenting condensed lists sized to fit into a wallet or cell phone case. ♥

♦ <u>https://fish4health.net</u>

Great Lakes AOC project team awarded for outreach efforts

LLINOIS-INDIANA SEA GRANT'S ASHLEY BELLE is part of an award-winning team working to inform residents and other stakeholders in a Great Lakes Area of Concern that is undergoing an environmental cleanup. Belle leads outreach efforts for the Spirit Lake Project Team that was recently presented a 2023 Western Dredging Association Environmental Excellence Award for Partnerships and Outreach/Education.

Spirit Lake is located in the St. Louis River between Minnesota and Wisconsin and is part of one of the largest Great Lakes Legacy Act sediment remediation projects. This work takes place near the Duluth, Minnesota neighborhood of Morgan Park and a culturally significant tribal site—Spirit Island.

As the cleanup progresses, Belle and the team have provided public meetings, regular updates for residents, online photo galleries, an onsite kiosk, and more. ♥



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Quick Splashes

Introduction to Rain Garden Design

A rain garden is a small-scale landscape feature that can help reduce flooding risks, minimize pollution, and enhance biodiversity and pollinator habitat. In this publication, university researchers explain how to site, size, design, install, and maintain a rain garden, and provide advice on plant selection too.

Biology and Ecology of Fishes

The third edition of this textbook provides an introduction to aquatic life and ecosystems and multidisciplinary fish studies, including the anatomical, environmental, and ethological topics of fish ecology. New content includes more information about emerging issues and stressors facing fish populations and communities, such as climate change, invasive species, and fisheries harvest.

Areas of Concern Revitalization Factsheets

A number of Great Lakes Areas of Concern have undergone an environmental cleanup through the Great Lakes Legacy Act. As a result, the cities along these waterways have seen environmental, economic, and quality of life benefits. Factsheets highlight revitalization in Muskegon, Michigan; Sheboygan, Wisconsin; Ashtabula, Ohio; Duluth, Minnesota; and Buffalo, New York.

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