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Montgomery County

FEBRUARY 2023



A supplement of the **Journal Review**



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2022 Director's Statement



MONTGOMERY COUNTY SOIL & WATER CONSERVATION DISTRICT

What a year! We accomplished a lot in 2022 with new events, new partnerships and a brand new urban soil health working group, Community Growers of Montgomery County.

We are still navigating hybrid events as we continue to offer some meetings both in-person and on Zoom. I was able to experience my first fourth grade field days after two years of cancellations. It is simply amazing what our team was able

to accomplish over those few days. We reached hundreds of students and were grateful for the wonderful weather.

The year brought some challenges as well. This year we had twice

the fieldwork in the fall as we were checking two years' worth of CRP practices. Double the waterways and double the filter strips to equal about 400 practices reviewed!

We have greatly expanded our out-

reach to include urban communities and we look forward to reaching new producers, community groups, and gardeners in the coming year. Thank you to all of our partners, the USDA service center staff and the dedicated citizens of the county for all their help in propelling our programs forward and helping to conserve the county's natural resources.

Kristen Latzke
Conservation Director

What is the SWCD?

The Montgomery County Soil and Water Conservation District (SWCD) is a legal subdivision of state government responsible for conserving natural resources within our county. Each of Indiana's 92 SWCD's is governed by a board consisting of five local citizens. Three board members are elected at the annual meeting and 2 are appointed by the State Soil Conservation Board based on recommendations of leadership in the district.

OUR MISSION

The purpose of the SWCD is to be a resource for the citizens of Montgomery County seeking information or assistance regarding conservation issues, as well as identifying and addressing natural resource concerns. The SWCD works alongside a variety of conservation organizations and government entities to provide conservation solutions at a local level.

WHAT DO WE DO?

The purpose of the SWCD is to be a resource for the citizens of Montgomery County seeking information or assistance regarding conservation issues, as well as identifying and addressing natural resource concerns. The SWCD works alongside a variety of conservation organizations and government entities to provide conservation solutions at a local level.

SERVICES WE OFFER

- Educational Events
- Invasive Species Technical Advise
- Garden/Small Farms Site Visits
- Forestry Technical Advise
- Volunteer Opportunities
- Native Plant Sale (Once A Year)
- Answering Of Questions Related To Natural Resources
- Soil Surveys To Answer Growers/Landowners Questions

HISTORY

The history of soil conservation and the creation of conservation

districts date back to national legislation passed by Franklin D. Roosevelt in 1937. States faced severe economic challenges during the Great Depression in the 1930s, which also coincided with an ecological disaster- the Dust Bowl. The Great Plains prairies gave rise to wheat fields as the western part of the US was settled. These farms were initially very successful, but the combination of intensive plowing and a severe drought turned these once-productive soils into dust. These soils, which took many years to form, simply blew away. Dust storms blocked out the sun and left everything in their wake in a blanket of dust.

On April 27, 1935 one of these great dust storms was headed toward Washington, D.C. when Hugh Hammond Bennett, known as the "father of soil conservation," spoke to members of Congress. Bennett believed that America needed "a tremendous national awakening to the need for action in bettering our

agricultural practices." As Bennett pled his case for soil conservation, the dust storm reached the city and darkened the sky. Bennett responded by saying that "This, gentlemen, is what I have been talking about." Congress then enacted the Soil Conservation Act of 1935, and the Standard State Soil Conservation Act of 1937. The first act created the Soil Conservation Service (now the Natural Resources Conservation Service), and the second encouraged the creation of conservation districts at the county level.

Soil and Water Conservation Districts (SWCDs) began in Indiana when the district law was established in 1940. This law was based upon the federal 1937 law, which calls for local citizens to petition for the creation of a conservation district in their county. SWCDs were founded on the concept that the implementation of federal conservation programs is best done through the coordination of local shareholders.

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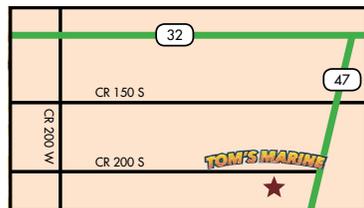


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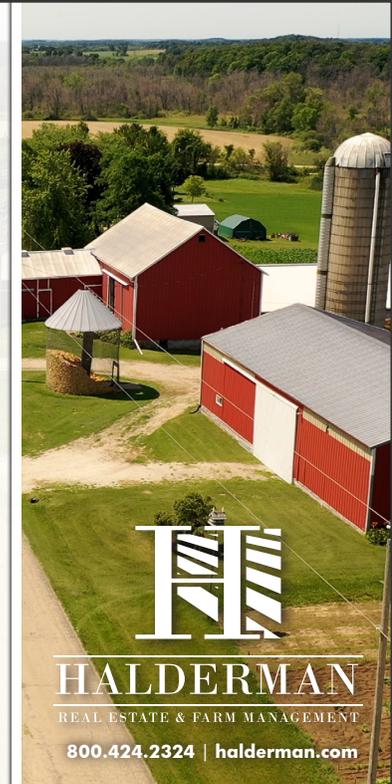
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Garden Walk 2022

Those interested in either starting a garden, are interested in learning new ways to garden, or would like to meet fellow gardeners in Crawfordsville participated in the Garden Walk on

July 30. This event started at 207 W. Main St. in Crawfordsville. There were multiple stops along Main Street with all types of gardens and gardeners.

At each stop the gardeners themselves shared information about their own garden and answered questions. The event was for gardeners of all experiences as their were hosts that have been gardening for two to three years all the way up to multiple decades. For this event participants walked together from garden to garden to allow gardeners to meet as many other gardeners in the area as possible and to allow the hosts to attend each others gardens.



Welcome back Fourth Grade Field Days

After two years of cancellations, we were able to bring back Fourth Grade Field Days. This is the 23rd year we have taught the fourth graders about the importance of natural resources through a variety of stations. We had 455 students join us at Cain's Homelike Farms in Darlington this year with all of the schools in the county attending.

The students were thrilled to be out of school for the day and on a working farm. We, the organizers, were happy to see the kid's eyes light up with excitement as they

got off the bus and saw the pond, the tractors, the hay ride, and more. The students who started in the morning at the water quality station spent their time until lunch alternating walking or riding around the pond to the incredible journey, wetlands, and erosion stations. After lunch, they transferred to the back four stations in the more forested area of the property. Here they learned about forestry, agriculture, wildlife/pollinators, and soils.

When students were asked what their favorite part of the day was most replied

with kissing the fish at water quality, the erosion table, or seeing all of the cool animals and insects at wetlands. This is a huge event that takes many volunteers donating their time. This year with the time spent preparing for the event, the two field days, and tearing down we had a total of 301 volunteer hours. We would like to thank all of our volunteers again for creating such an amazing event and especially the Cain Family for hosting and all the hard work they contribute to this event every year.



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Purdue research buzzing about construction lessons taken from bees, honeycombs

WEST LAFAYETTE, Ind. – Purdue University engineers and entomologists are making some sweet discoveries about how honeybees build and structure their honeycombs, which could lead to new fabrication techniques taken from the buzzing builders.

Nikhilesh Chawla, the Ransburg Professor of Materials Engineering at Purdue, is one of the first to utilize four-dimensional (4D) imaging to delve further into the complexities of the honeycomb. The imaging allows a time-lapse view of the bees' work without cutting into their home.

The innovative view of the bees' construction found techniques that could eventually translate into new concepts for structural materials or additive manufacturing for the construction industry. Chawla said some of the junctions between the honeycomb cells were created using less material, with the resulting porous connections resembling Swiss cheese.

"It's a lesson in materials utilization that could lend itself to new ideas and practices in structures," Chawla said. "Their honeycombs are still perfectly fine. From that perspective, humans may not actually need as much material in some areas that are not quite as important from a structural point of view."

Honeycombs are the self-built, multifunctional homes for honeybees, providing a place to store food and serving as a nursery for eggs and larvae in addition to shelter. Made from wax produced by the bees, the hexagonal cells are easily recognized.

Chawla's work shows how humans can draw important lessons from the plant and animal world in a discipline called biomimicry, which investigates naturally occurring materials and behaviors and draws inspiration to design new products, systems and buildings. Chawla said there are as-

pects of honeycombs already used in several applications, from construction and structural materials to shoes.

Nikhilesh Chawla, the Ransburg Professor of Materials Engineering at Purdue University, and Rahul Franklin, a graduate research assistant in materials engineering, look over one of many comb samples used in their biomimicry research. Biomimicry is a discipline that draws important lessons from nature to be used by humans.

The Purdue research team is made up of Chawla; Brock Harpur, assistant professor of entomology in the College of Agriculture; and Rahul Franklin, a graduate research assistant in materials engineering. Their work was published in the journal *Advanced Materials*.

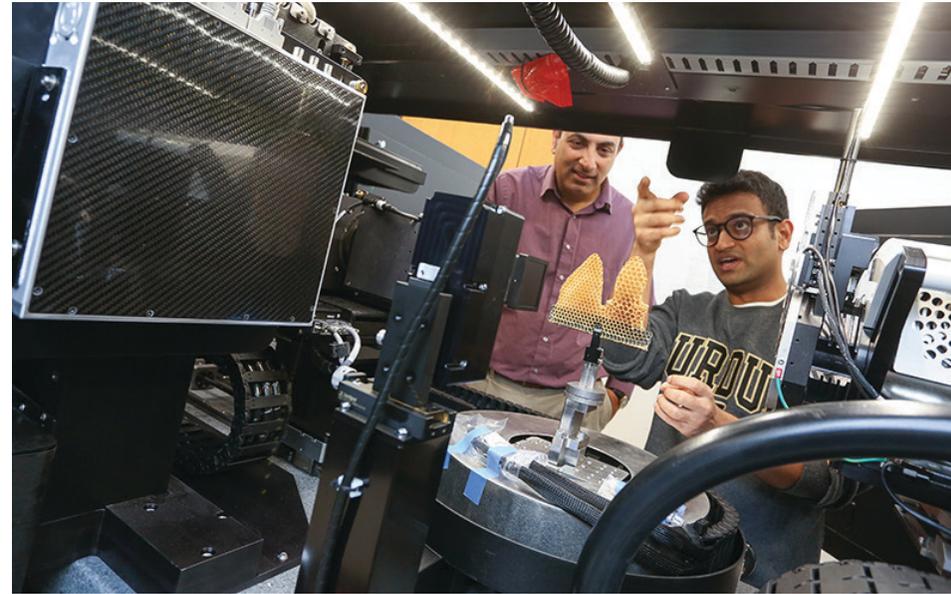
Chawla said people don't truly understand how bees make the honeycombs. For example, most theorize the honeycomb chambers start as cylinders and then are molded by the bees into the well-known hexagonal shape.

But a sophisticated three-dimensional (3D) X-ray microscopy technique combined with a time lapse provided an unprecedented means of studying and quantifying the honeycomb's microstructure.

The resulting 4D imaging showed chambers are built with panels. Research also found bees go to great lengths to strengthen the honeycomb structure by first creating a vertical spine for support and then building the hexagon cells out horizontally.

"Over time, they continue to make the spine thicker because they understand there is more weight from the wax on it, and they need that backbone to be strong and rigid before they can add more and more of these cells growing outwardly," Chawla said.

Chawla's overall research focuses on four-dimensional materials science.



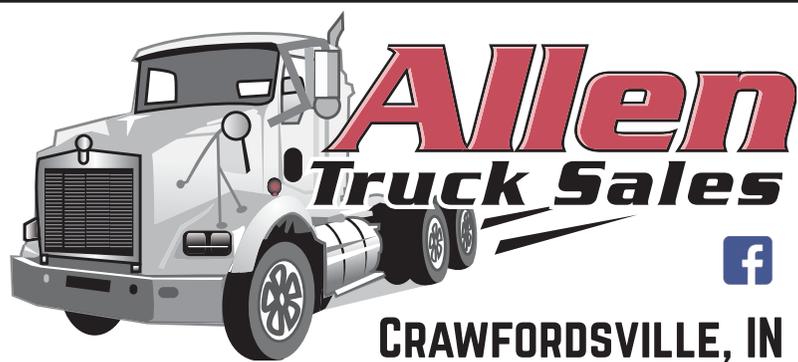
The approach – called tomography – uses nondestructive X-rays to add time as a fourth dimension to 3D measurements and analyses. The 4D approach is important in examining structural evolution, including deformation and corrosion that take place over time.

Learning from honeybees is just the first step in the Purdue team's biomimicry research. Successfully applying those lessons with tools like 3D printing is next. Chawla said

there are plans to build honeycombs of different sizes and even different shapes and evaluate their durability with compression tests.

In addition to honeybees, Chawla's biomimicry research involves looking at the porous cellular structure of cacti and how fluids are moved up and down throughout the plant.

"It's just a lot of fun to work with these kinds of natural materials because you just never know what you're going to find," he said.



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Gillenwaters host farm tour

The Community Growers of Montgomery County held a Farm Tour with Gillenwater Farms and Trinity Acres Farm on June 4, 2022. Attendees included fellow producers, homesteaders, and customers of the two farms. The speakers of this tour

were Jordan and Paige Gillenwater at Gillenwater Farms and Gary Cox and David Schamber at Trinity Acres Farm.

The Gillenwaters spoke about their produce, hogs, beef, selling at Four Seasons Local Market in comparison

to farmers markets, and more. Gary and David spoke about their CSA boxes (Community Supported Agriculture), selling at farmers markets, extending their growing season with high tunnels, being organic, and how they suppress weed pressure.

Attendees were able to ask various questions which led to great conversation throughout the entire event. We hope to make Farm Tours throughout the County an annual event.

SWCD Staff

• Kristen Latzke, Conservation Director

Kristen is originally from South Bend, Indiana. She attended Purdue and received a bachelor's degree in Animal Science from the College of Agriculture. She spent a few years focused on wildlife conservation before coming to the district to focus on natural resource conservation. Her favorite part of her job is the grant work, especially when she can be out in the field. She lives on the Northwest side of Indianapolis with her husband, daughter, and two dogs.

• Megan Sweeney, Program Coordinator

Megan started as the Program Coordinator with the SWCD in August of 2021. She is in charge of programming, events, and outreach for the district. Megan graduated from in May of 2020 Ohio University with a degree in Environmental Biology. After graduating she served as an AmeriCorps Member with Green Iowa AmeriCorps. Through this position she was able to work with Practical Farmers of Iowa to help create farmer-led programming for other farmers. Megan graduated from the Indiana Watershed Leadership Academy through Purdue Extension this month which she will use in her day to day work. Contact Megan with any questions relating to upcoming events, invasive species, or backyard conservation techniques.

• David Stanley, District Conservationist

Dave graduated from Purdue University with a degree in Soil and Crop Management in 1991. Dave started back in 1990 with NRCS - Natural Resources Conservation Service - back then the Soil Conservation Service as a student trainee. He has been in his current position as the District Conservationist in Montgomery County since 1994. Dave farms on his family farm with a corn and soybean rotation and he has been no-till since 1994.

If you are a private landowner in Montgomery County and have a resource concern like soil erosion, water quality, invasive species, etc. you can reach out to Dave about possible programs to help fund solutions for those resource concerns.

SUPERVISORS

- Jordan Gillenwater, chairman
- Marc Roberts, vice chairman

Marc lives East of Mace with his wife and 4 kids. He sells seed, has a small agronomics projects business, and farms with his father-in law. Some of the conservation practices that he's used include CRP for grassed waterways, CSP primarily for cover crops, and EQIP for heavy use areas, timber stand improvement, and currently is working on an EQIP fencing project.

- Raoul Moore, secretary/treasurer

Raoul's family moved to the area in 1954 when his father got an English Professor job at Wabash. In 1956 his family moved to a 40 acre hobby farm north of town at junction of Walnut Fork and Sugar Creek. They grew most of their food and truck farmed for some income. His father did timber stand improvement and planted a hard to access field near the creek to trees in 1958. One of those walnut seedlings is now 24" diameter at breast height (DBH). The Moore Family Farm currently has about 700 acres of woodlands with about half of those as plantations from 25 different years. The changes in AG have made many smaller, high perimeter to volume fields uneconomic to farm. Some soils since the clearing off of the state and 100 years of plowing have lost fertility also making them unattractive for farming. Raoul's hope is to get more people nurturing their woodlands and converting areas to trees.

- Aron Rhoads
- Daniel Bullerdick

Different agencies offer a variety of conservation programs to assist landowners or producers, and it can be difficult to decide which program is right for you. The Montgomery County SWCD belongs to the Indiana Conservation Partnership (ICP). This collective group of agencies and organizations work together to promote conservation in Indiana. The mission of the ICP is to provide technical, economically, and

environmentally compatible land and water stewardship decisions, practices, and technologies.

PARTNERSHIPS

Indiana Association of Soil and Water Conservation Districts
Indiana Department of Environmental Management
Indiana Department of Natural Resources
Indiana State Department of Agriculture, Division of Soil Conservation
Purdue Cooperative Extension Service
State Soil Conservation Board
USDA Farm Service Agency
USDA Natural Resources Conservation Service
Carnegie Museum of Montgomery County
City of Crawfordsville
Crawfordsville District Public Library
Crawfordsville Parks and Recreation Department
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Friends of Sugar Creek
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Women4theLand

Women4theLand is an initiative of agricultural and natural resource conservation partners working to provide information, resources and networking opportunities to Indiana women landowners and farmers.

Here in Montgomery County we

work with W4L to host events to create a network of women supporting conservation. If you have recently inherited land and have questions on how to manage it, please do not hesitate to reach out to us with questions. We will connect you with the resource-

es you need!

For upcoming W4L events please visit our event page. To learn more about W4L visit their website

<https://women4theland.org/>

Further Resources:

Purdue Extension- Women in Agriculture

Women Food & Ag Network (WFAN)

Women in Natural Resource Conservation Service (WIN)

80th annual meeting recap

We hosted our 80th annual meeting on March 7, 2022, at Stone Creek Lodge. It was catered by The Juniper Spoon and we were very thankful to have Lali Hess as a keynote speaker. A special thank you to our friends at Farm Credit Mid-America for sponsoring this year's keynote.

In addition to celebrating 80 years of conservation, we were able to recognize multiple community members for their outstanding work. We highlighted Jeff Lough for 24 years on the district board. We also recognized Cain's Farms Inc. as they were awarded the River-Friendly Farmer award at last year's state fair. The 2021 Conservation Farmer of the Year was awarded

to Hester Brothers Farms LLC. Dave Stanley, NRCS District Conservationist, presented awards to all three.

•••

The Hester family is committed to conservation

Brian and Todd Hester from Hester Brothers Farms LLC new New Market were awarded the 2021 Conservation Farmer of the Year Award. The two brothers were influenced by their father, Russell Hester, who farmed before them. Russell started conservation in the mid-1980s by creating temporary critical areas seeding wheat cover on highly erosive areas. A few years later he began no-tilling soybeans into corn stalks. After seeing

success of no-till beans, three years later they started no-tilling corn into soybean stubble. They had to adapt their CaseIH 900 cyclo air-planter for starter fertilizer and no-till accessories in order to plant no-till corn. Starting in the 90s along with their 100% no-till operation they started experimenting with side dressing nitrogen and feeding the plants when they need nitrogen instead of using pre-plant nitrogen. The Hester brothers learned that higher rates of nitrogen in starter fertilizer along with planting when conditions are dry and warm made for successful no-till corn. Once the no-till system became prosperous it allowed them to get their own sprayer

and GPS technology to help improve weed control and spraying conditions.

In the past few years, the Hester brothers have been experimenting with increased soil health practices. Along with their no-till system they are planting cereal rye into corn stalks to use as a cover crop. In the Spring, they plant soybeans into the green cereal rye and use it to mulch the beans. They are also experimenting with interseeding corn in 15 inch rows in a clover cover crop. The corn is planted once the oats are winterkilled. This clover will produce nitrogen for the growing corn crop next year. Thank you to the Hester family for your commitment to conversation.

Upper Sugar Creek Watershed Project

4th Quarter Update: Aug. 18- Nov. 17
Sara Peel, Arion Consultants

The second draft of the watershed management plan was submitted to IDEM on Aug. 15, 2022. The

steering committee met on Oct. 25, 2022, to review stakeholder concerns and associated data.

Water chemistry monitoring occurred on Aug. 17, Sept. 28, Oct. 24, and Nov. 16, and will occur through

the end of the year. Biological monitoring occurred in July and August with fish community assessments occurring on July 18-20 and Aug. 1 and macroinvertebrate community and habitat assessments occurring on July 15-16. Macroinvertebrate community identification is underway and the species list and IBI, mIBI and QHEI data will be included in the next draft of the watershed management plan.

The Upper Sugar Creek steering committee met Oct. 25, 2022, reviewed stakeholder concerns and associated evidence as well as discussed upcoming outreach events. Wabash College students are working to compile public meeting comments and results and transcriptions from the farmer listening session, which will be incorporated into the next WMP draft. The Mont-

gomery County SWCD social media will be used to promote the project and has been updated 18 times with relevant information. The Upper Sugar Creek informational brochure continues to be distributed including at the farmer listening session and at high-profile locations.



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Josh & Brittany McCloud

Community Growers of Montgomery County

In 2021 a working group aimed towards helping backyards gardeners, small farmers, and landowners in Montgomery County was formed in partnership with Indiana Association of Soil and Water Conservation Districts. Organizations and members involved with the working group include Montgomery County Soil and Water Conservation District, Natural Resources Conservation Service, Sustainable Initiatives of Montgomery County, Master Gardeners of Montgomery County, and Purdue Extension.

Mission
Provide public education focused on local food, soil, and sustainability while connecting a diverse community of growers.

Vision
Connecting a community of growers to create a Montgomery County that fosters fellowship, healthy soils, and thriving local food systems.

Values
Accessible Education

Community Engagement
Welcoming Everyone
Soil Health
Stewardship of Land and Resources

What can we do for you?
Site Visits

Are you a grower or looking to start growing your own food? We are here to help with any questions you may have. Site visits are an initial visit with a producer, grower, landowner, or land user to assess

resources and discuss resources concerns and soil health opportunities. This is an initiative with our new working group Community Growers of Montgomery County. It is free of charge and open to everyone in Montgomery County. If you are having issues with your garden or operation, or want to start a new garden and don't know where to start please reach out to SWCD's Program Coordinator, Megan Sweeney, at msweeney@montgomery-coswcd.com or 765-362-0405 ext. 3.



Tabling at the Farmers Market



Farmer Float Trip 2022

Friends of Sugar Creek conducted its 2nd annual Farmer Float Trip on July 26, 2022. This was a fee event with

lunch included.

Participants learned about what the FOSC and the district are doing to preserve Sugar Creek for all future generations to enjoy.



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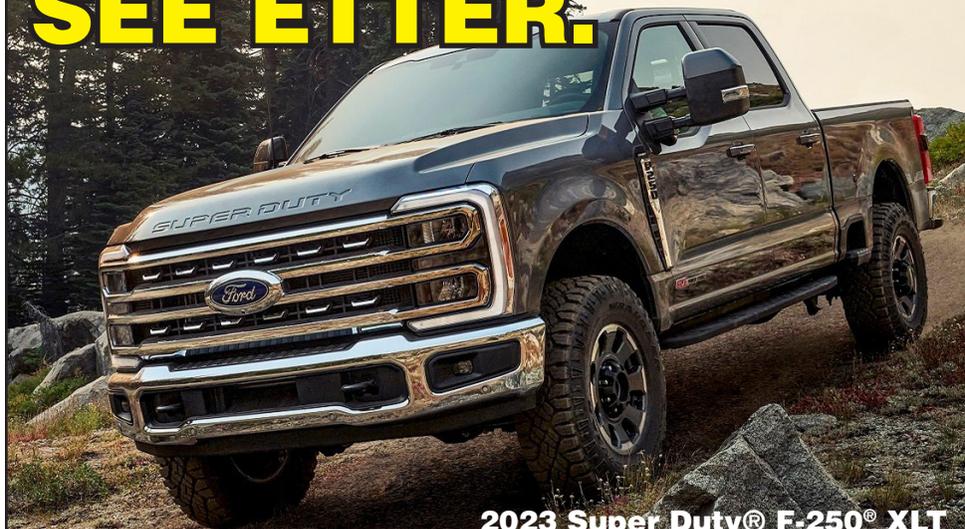


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Kyler



October 2022 Events

Here at the office we had an October full of forestry themed events! We removed a ton of invasive species, both on the Sugar Creek Trail and our office complex, including honey

suckle, burning bush, and spirea with the help from the public and two lab sections from Wabash college. We also had a Women4theLand Forestry Learning Circle where women land-

owners were able to learn, ask questions, and teach each other about all things forest management. We have wrapped up all of our events for the year, but check back in next year

on our website at <https://montgomerycoswcd.com/events/> to find events that may interest you.

Springtime makes some invasives easy to spot

Oftentimes invasive species are easy to spot as they have a tendency to green up before other species both in the forest and in ornamental settings. One of the best examples of this is the Callery Pear Tree, with the most notable cultivar being the Bradford Pear. All ornamental pear trees are considered Callery pears; some cultivars include Aristocrat, Cleveland Select, Autumn Blaze, and Capital. This species is native to China, Taiwan, Japan,

and Vietnam.

These trees have been widely planted in the past because they are attractive and fast-growing. With the creation of multiple cultivars, the once sterile trees now have abundant fruit. Birds eat the fruit and carry the seeds across the landscape which allows them to invade natural areas. Now the Callery pear is recognized as an invasive species that forms dense thickets, outcompetes natural plants, degrades

wildlife habitat, and creates problems along roadsides.

This is why planting native plants is so vital. Native plants are beautiful and they benefit birds and other wildlife. They are able to support multiple pollinators and insects which provides food for Indiana birds. Also as they evolved in this area with other species native to the area, natives have a tendency to be more resistant to disease and insects requiring less

maintenance. This means you save time and money!

A few native alternatives to the Callery Pear include Serviceberry, Flowering Dogwood, and Redbud. We have a few of these species available at our native plant sale coming up later this month. Check out the info to the right to see what species we have available and how you can plant some natives on your land.

Tackling Invasive Plants

A Cooperative Invasive Species Management Area (CISMA) is a local group or partnership of people who collectively manage the problem of invasive species spreading across the landscape. CISMAs operate by engaging local interests and addressing invasive species issues across various land ownership. Work began here in Montgomery County in 2020 to establish a local CISMA.

Invasive plants are plants that are not native (local) to Indiana and are rapidly spreading and outcompeting native plants. Wintercreeper is one species of concern here in our county. Invasive plants decrease soil quality, water quality, and biodiversity. If you are concerned about invasive species on your property please contact us for assistance! We will connect you with resources to help identify and eradi-

cate invasives.

We need community member's input to best fit the serve the needs of this county. Our initial CISMA survey is available now. By completing this survey you are helping us determine the best course of action to get invasives under control here in the county! If you are interested in helping in our efforts to rid the county of invasive plants this survey will also let us know how you would like to help.

Montgomery County CISMA Mission

Our mission is to manage the problem of invasive species spreading across the landscape. We operate by engaging local interests and addressing invasive species issues across various types of land.

Values

- Welcoming everyone
- Stewardship of land and resources
- Collaboration, community, and integrity

Vision

A Montgomery County, Indiana with great soil health and clean water with mostly native species within it's forests, cropland and waters.

How can you get involved?

- Volunteer
 - Volunteer at weed wrangles
 - Donate your time to CISMA by helping with marketing, organizing, advertising, mailings, etc.

At Home

- Plant natives
- Are you interested in a site

visit from a regional specialist from SICIM to create an invasive species management plan for your land? Request assistance from the Regional Specialist in your area by clicking the button below

- Remove invasives on your own land

Spread the Word

- Help spread the word about the importance of invasive species to your neighbors and other community members

Share your Expertise

- If you are knowledgeable about invasive species, natives, etc. donate your expertise



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Federal grant funds available for specialty crop industry

INDIANAPOLIS — The Indiana State Department of Agriculture (ISDA), beginning Feb. 15, will seek project proposals from Indiana's specialty crop sector for funding from the U.S. Department of Agriculture's (USDA) Specialty Crop Block Grant Program.

"Specialty crops are big business in Indiana," said Lt. Gov. Suzanne Crouch, Indiana's Secretary of Agriculture and Rural Development. "This unique sector is quite large in Indiana, after all 80% of our state is farmland and forests. We are excited to use this federal funding to bol-

ster our large specialty crop sector and research initiatives."

The USDA Specialty Crop Block Grant Program offers federal funding annually to state departments of agriculture to support their specialty crop industries. This year, Indiana's allocation is \$484,966.

Eligible projects must enhance the competitiveness of specialty crops in Indiana, defined as fruits, vegetables, tree nuts, horticulture and nursery crops.

Funding will not be awarded to projects that benefit a particular commercial product, or provide a profit to a single

organization, institution or individual. Each project must identify at least one of the new USDA performance measures that specifically demonstrate the project's impact on enhancing the competitiveness of eligible specialty crops.

ISDA is seeking projects that have objectives such as: increasing consumption and consumer purchasing, increasing access and distribution, increasing food safety knowledge and processing, developing new seed varieties and improving environmental sustainability, among other things. Click here or visit ams.usda.gov to

see the full list of performance measures.

ISDA and USDA encourage applications that benefit smaller farms, new and beginning farmers, underserved producers, veteran producers and underserved communities.

Applications are due by noon ET on March 10. Proposals must be submitted online through the Indiana State Department of Agriculture's Grants Management System. Indiana Specialty Crop Block Grant application resources are located on ISDA's Grants and Funding Opportunities website.

Purdue launches new AI-based global forest mapping project

WEST LAFAYETTE, Ind. — Purdue University's Jingjing Liang has received a two-year, \$870,000 grant from the World Resources Institute to map global forest carbon accumulation rates.

"To accurately capture the carbon accumulation rates of forested ecosystems across the world has always been a challenging task, mostly because doing so requires lots of ground-sourced data, and currently such data are very limited to the scientific community," said Liang, an associate professor of quantitative forest ecology and co-director of the Forest Advanced Computing and Artificial Intelligence Lab.

"This task is considerably more challenging than mapping carbon emissions from forest loss," said Nancy Harris, research director of the Land & Carbon Lab at the World Resources Institute, a nonprofit research organization based in Washington, D.C. "With emissions, there's a clear signal in satellite imagery when trees are cut, leading to a big drop in forest carbon stocks and a relatively abrupt pulse of emissions to the atmosphere. With sequestration, forests accumulate carbon gradually and nonlinearly.

"Even the most advanced satellite sensor can't capture this reliably on its own, especially in older forests where the signal saturates. A forest stops getting taller long before it stops accumulating carbon."

Forest carbon accumulation rates are sensitive to the subtle changes in three forest growth components: ingrowth, up-

growth and mortality. Ingrowth represents the number of small seedlings that have attained a specific threshold size to be called trees. Upgrowth is the gradual increase in diameter of trees through the process of photosynthesis. Ground-sourced forest inventory data measured at multiple points in time is currently the only reliable source of information for accurate quantification of these three forest growth components.

"To date, people have never been able to estimate the ingrowth, upgrowth and mortality rates of individual forest stands at a global scale. This information gap leaves huge uncertainty in the size, location and trend of global forest carbon sink," Liang said.

The new World Resources Institute project at Purdue will draw upon the massive ground-sourced forest inventory data with remeasurements, collated by Science-i and the Global Forest Biodiversity Initiative.

Liang is developing an artificial intelligence model that will combine information collected about billions of trees measured on-site with satellite and other geospatial data to map local forest growth rates throughout the global forest range.

"This will be the first AI-based forest growth model deployed at a global scale," he said. Beyond accurately quantifying carbon dynamics, Liang's AI-based forest growth model will also capture the dynamics of forest biodiversity and timber quality.

"We're excited to support the growth of this research collaboration," Harris said.

"The spatially granular data this new project will provide will help us better understand the role our planet's forests play in local, nature-based solutions to mitigate global climate change. The inclusive and globally networked approach of this initiative is at the heart of the mission of WRI's Land & Carbon Lab."

Developing such a model requires massive computing power and comprehensive global data coverage. The state-of-the-art high-performance computing clusters at Purdue will provide sufficient computing support. Still, achieving comprehensive global coverage of ground-sourced plot data remains a challenge, particularly in tropical countries.

"The data from these countries have been limited historically," Liang said. "Through the newly established network of Science-i and its sister consortium, the Global Forest Biodiversity Initiative, we already have working relationships with a large number of scientists across the world who are collecting and sharing those data."

Liang founded Science-i, a web-based collaboration platform involving more than 300 scientists around the world. He also co-founded the Global Forest Biodiversity Initiative, which has built a database of 1.3 million sample plots and 55 million trees. That database will serve as the project's basis.

"We are going to collect much more data, especially from the global south,

to fill those data gaps," Liang said. "We will get more people involved, especially those from underrepresented groups."

Collaborators of this project already include representatives of Indigenous groups across North America, Amazonia, Africa and elsewhere. Rural communities, forestry practitioners and citizen scientists will also become project collaborators.

"We co-produce the knowledge based on the FAIR principle of global collaboration: findable, accessible, interoperable and reusable," Liang said.

"In Science-i, everyone collaborates with each other as equal partners on all projects. We openly share our findings with transparent real-time discussions across the whole team. Then we cross-evaluate and consolidate our research findings at the end. This is a brand-new way to do international collaborative forest research."

The extensive global partnership and comprehensive forest tree database created from this project will complement Purdue's Digital Forestry Initiative, which seeks to leverage technology and multidisciplinary expertise to measure, monitor and manage urban and rural forests.

Liang is co-lead, with Ximena Bernal, associate professor of biological sciences, for the Biodiversity Research Community, part of Purdue's recently launched multidisciplinary Institute for a Sustainable Future.



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Purdue Extension studies Indiana commercial solar and wind county ordinances wind-farm

WEST LAFAYETTE, Ind. — In spring 2022, the Indiana General Assembly passed Senate Bill 411, creating voluntary commercial solar and wind regulation standards. Indiana communities planning to qualify as a solar or wind energy ready community will need to examine their county ordinances in comparison with the Indiana state voluntary standards.

Purdue Extension's Land Use Team, in collaboration with the Indiana Office of Energy Development, recently published two renewable energy

reports to help aid in the discussion of renewable energy land-use regulations.

The studies compared the voluntary state standards to current Indiana county zoning ordinances using data from the Indiana Renewable Energy Community Planning Survey and Ordinance Inventory Summary, which was completed by the Land Use Team in 2021. The analysis did not include counties without planning and zoning or zoning standards specific to commercial solar or wind development.

The study found 54 counties with commercial solar energy defined as a use in their zoning ordinance. None of the counties comply with all 11 categories outlined in the updated Indiana legislation. A total of 52 counties defined commercial wind energy as a use in their zoning ordinance with two counties complying with all nine categories set forth in the legislation.

"Planning and zoning regulations often reflect the local communities' characteristics, resources and considerations. These reports reflect that in

the myriad ways counties have chosen to regulate commercial wind and solar developments," said Tamara Ogle, community development regional educator for Purdue Extension and member of the Land Use Team.

The two reports are available online. The Purdue Extension Land Use Team provides research-based resources and educational programs for Extension professionals, government officials, citizen planners and residents on land-use issues affecting their communities.

Purdue economic impact study proves Indiana Grown delivers value

INDIANAPOLIS – Indiana Grown worked with the Purdue University Department of Agricultural Economics to determine the economic impact and growth of the Indiana Grown program through a collaborative, science-driven approach. The study showed that every dollar spent via Indiana Grown activities resulted in \$0.97 in additional economic activity within Indiana.

"The economic impact study conducted by Purdue shows how valuable Indiana Grown is to the state," said Lt. Gov. Suzanne Crouch, who also serves as Indiana's Secretary of Agriculture and Rural Development. "I am grateful to show our Indiana Grown members that their hard work and dedication to the program is paying off."

Consumer survey results showed that over 33% of Hoosier's have awareness and perceptions of the Indiana Grown program and label. For Indiana Grown members, the survey found that the value of the program to their business is equivalent to approximately \$13,600.

"This data is crucial for us to grow

the program and address the needs of both our Indiana Grown members and consumers," said Caroline Patrick, director of Indiana Grown. "I am excited to use this study to propel the program forward and look forward to many years of continued economic growth for local products and businesses."

To determine this data the Purdue team distributed a state-wide questionnaire to Hoosiers to detect consumer awareness, quantified consumer willingness to pay for locally made or grown products and surveyed Indiana Grown members to determine the drivers and benefits of being a member of the program.

For the economic contributions of the Indiana Grown program, the data showed that the total economic footprint of the Indiana Grown program was \$13.91 million as of 2020.

"This project was a great example of the partnership between ISDA, Purdue's Department of Agricultural Economics, and Purdue Extension Community Development," said Dr. Michael Wilcox,

Community and Regional Economics specialist with the Department of Agricultural Economics for Purdue University. "We set out to explore the impact and potential of Indiana Grown from the perspective of consumers, producers (the Indiana Grown members), and the Indiana economy in a rigorous and defensible way. This unique study helps ISDA and Indiana Grown make data-driven decisions about how to continue best supporting Indiana agricultural product branding, and local agri-entrepreneurs that provide value-added agricultural products to consumers in Indiana and beyond."

For Indiana Grown producers, the survey found that members are satisfied with their membership and would recommend the program to others. Additionally, member respondents enjoyed the promotional and marketing events and would like to see more events in 2023. According to the data, most Indiana Grown members joined the program in 2018, particularly in the proteins, livestock, horticulture, grains and

oil operations. Likewise, 2020 was the year with the second-highest number of producers enrolled in Indiana Grown, those categories of new members were horticulture, grains, oils, proteins, livestock, wholesale and retail.

"As an Indiana Grown member, the data collected in the study is so valuable in knowing that this program truly enhances my business and sales," said Rachel Boyer, owner of Rachel's Taste of Indiana in Converse. "I love encouraging consumers to shop local and I am passionate about the Indiana Grown program. I was thrilled to see this study come to life and see that what we thought all along, that consumers enjoy shopping local, really is true."

This data was collected from September 2019 to September 2022 and was funded for nearly through the USDA's Federal State Marketing Improvement Program. To view the full study, click here.

Learn more about Indiana Grown at indianagrown.org.

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USDA Forest Service accepting grant applications for wood innovations projects, community wood energy facilities

WASHINGTON – The U.S. Department of Agriculture’s Forest Service today announced it will offer \$41 million through the 2023 Wood Innovations Grant and 2023 Community Wood Grant programs to spark innovation and create new markets for wood products and renewable wood energy.

Made possible in part by President Biden’s Bipartisan Infrastructure Law and the Inflation Reduction Act, these grants expand wood products use and strengthen emerging wood energy markets, supporting sustainable forest management – particularly in areas of high wildfire risk.

“With the support of the Inflation Reduction Act and the Bipartisan Infrastructure Law, USDA is carrying out the Biden-Harris Administration’s mission to support rural, forest-dependent communities while fighting climate change and protecting our natural resources,” said Agriculture Secretary Tom Vilsack.

“These grant programs provide opportunities for communities and businesses to develop innovative uses and markets for wood, a renewable and economical resource,” said Forest Service Chief Randy Moore. “Previous Wood Innovations Grants are making a difference across the country, and we are pleased to continue supporting wood use ingenuity that helps our communities and forests.”

The application deadline for both grant programs is March 23 at 5 p.m. local time. Applications may be submitted via email to the Forest Service Regional Wood Innovations coordinator listed in the application instructions.

Not only are these grants helping support local economies by expanding the potential of wood products and wood energy, they are also helping address critical issues like climate change. By finding new uses and expanding current uses for wood products and energy made from materials removed from unhealthy, overgrown forests, we can restore forests to health, reduce wildfire risk, fight climate change and sustain local economies.

The Wood Innovations Grant Program makes funding available to expand traditional wood use projects, advance wood energy markets, and promote wood use in commercial building construction. This Request for Proposals focuses on the program’s market development goals to reduce hazardous fuels and improve forest health on national forests and other forest lands, reduce the costs of forest management, and promote economically strong and environmentally healthy communities.

Eligible project examples include:

- Architectural and engineering designs, cost analyses, and permitting to secure financing for commercial wood construction or wood

energy projects development.

- Establishing or increasing wood products manufacturing to support forest restoration.
 - Showcasing environmental and economic benefits of wood as a sustainable commercial building material to encourage growth in the industry.
 - Establishing statewide wood use teams or wood energy teams.
 - Developing wood energy projects that use residues from wood products or woody biomass.
 - Developing commercial woody biomass and wood product industrial parks.
 - Overcoming market barriers to stimulate wood energy expansion.
 - Purchasing wood processing equipment to create markets supporting forest management.
- The Community Wood Grant Program funds shovel-ready projects to install thermally led community wood energy systems or build innovative wood product facilities to support healthy forests and stimulate local economies by expanding renewable wood energy and innovative wood products manufacturing capacity.
- Eligible project examples include:
- Community wood heating, cooling, or electricity systems that replace fossil fuels.
 - Purchase and installation of manufacturing equipment at a mass timber production facility.
 - Expanding sawmills with inno-

vative technologies, cost cutting measures and higher value production lines.

- Equipment purchase and installation at new facilities producing forest products biofuels.

To apply for either grant, applicants must be registered with the System for Award Management (SAM). Applications should show a clear benefit to underserved or historically marginalized people, communities, and the forests they value. For-profit entities, state and local governments, Indian Tribes, school districts, non-profit organizations, higher education institutions, public utilities, and fire and conservation districts are eligible to apply.

More information is available at the Forest Service Wood Innovations website or at grants.gov.

2023 Wood Innovations Funding Opportunity: www.grants.gov/web/grants/view-opportunity.html?opId=345548

2023 Community Wood Energy and Wood Innovation Program: www.grants.gov/web/grants/view-opportunity.html?opId=345549

Since 2015, the Community Wood Grant and Wood Innovation Grant programs have provided more than \$93 million to 381 recipients to support wood products and wood energy projects.



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Hoosier soil, ‘the veneer that sustains us,’ eroding away: Advocates work for overdue update in state funding for conservation

Mark Bennett

HSPA Infonet

As a school kid growing up in the 1950s, Les Zimmerman devoured the Weekly Reader newspapers at his school. One particular story inspired a lifetime passion.

As a school kid growing up in the 1950s, Les Zimmerman devoured the Weekly Reader newspapers at his school. One particular story inspired a lifetime passion.

It described the near-extinction of a species of whooping cranes. Fewer than two dozen existed at the time, because of the loss of their habitat.

“That article spoke to me,” Zimmerman recalled more than six decades later.

Now, at age 75, the retired Vermillion County plant nursery operator still believes natural resources must be protected. He doesn’t flinch when friends call him a “tree hugger.” “It’s OK to be a tree hugger,” Zimmerman said inside a Terre Haute coffeehouse on Monday morning. “In fact, you ought to embrace it.”

Zimmerman also approaches with pragmatism his role as legislative chair for the Indiana Association of Soil and Water Conservation Districts. The group is advocating for an overdue increase in state funding for local soil and water conservation districts in each of Indiana’s 92 counties.

The IASWCD (yes, it’s a long acronym) is asking the Indiana General Assembly for an \$8.6-million annual increase in funding for the Clean Water Indiana program.

That program, established at the turn of the 21st century, supports the implementation of conservation practices to reduce topsoil and nu-

trient loss through erosion, eradicate invasive species, curtail wildlife habitat loss and prevent degradation of groundwater and surface water. At the time of its launch, the Clean Water Indiana program distributed \$10,000 annually to each of the 92 soil and water conservation districts. It also provided a \$970,000 pool of funding for grants for which conservation districts could compete.

Those funding totals haven’t changed in the nearly quarter-century since Clean Water Indiana was established.

Thus, Indiana trails other Midwestern states by a longshot in funding for local conservation districts, which were created in the aftermath of the “Dust Bowl” era of the 1930s. Even if the state Legislature agrees to the \$8.6-million increase the IASWCD seeks in the General Assembly’s current session, Indiana would only move up to next-to-last in per-county funding in the Midwest, according to calculations by the Indiana Prairie Farmer publication.

“[Annual funding] should be \$18,000 [per district] to reflect inflation over 23 years, and the same goes for that pool” for the competitive grants, Zimmerman said. “The need is just overwhelming.”

Zimmerman used the loss of rich Hoosier farm soil as a prime example of that need. Soil washes away from croplands and into bodies of water from Lake Monroe to the Gulf of Mexico.

“Over the course of the last 100 years, we have lost one-third of our crop soil, which is the veneer that sustains us,” Zimmerman said.

It amounts to 100 million tons per

year. That’s a lot of dirt. If 4 million semi-tractor trailer trucks, each overloaded with 25 tons of soil, were lined up bumper to bumper, such a convoy toting a combined 100 million tons of earth would extend 19,000 miles, Zimmerman explained.

“What we’re about is protecting the productive capacity of our farmland and not sending to New Orleans,” Zimmerman said.

State initiatives, including the Clean Water Indiana program, have helped reduce Indiana’s soil erosion dilemma. Since 1987, the average annual loss of soil on Hoosier cropland has declined 31%, from 4.5 tons to 3.1 tons per acre, according to the Purdue University “Soils Judging Manual.”

Erosion remains problematic and costly, though. Farm sediment washing into Indiana rivers, streams, lakes and ponds leads to “poor water quality, diminished recreational use, reduced storage capacity, reduced floodwater retention, degradation of aquatic life and depreciated property values,” that same Purdue report explained, as well as algae growth and pollution. “It is cheaper to prevent erosion problems than to correct them,” it reads.

An \$8.6-million annual increase in conservation funding would help confront soil loss through the technical assistance and education supplied by county conservation districts, while also bolstering resources for invasive species control projects and staffing, Zimmerman said. Much of the work to contain and eradicate invasive plants, which choke out space and nutrients for native species, is led by the State of Indiana Cooperative Invasives Management (or SICIM).

Amber Slaughterbeck, SICIM’s west central Indiana regional specialist, sees significant benefits to boosting resources for conservation. “An increase in funding for conservation projects statewide is the way forward to preserve and rebuild functional habitat in Indiana,” Slaughterbeck said Thursday, “and we can do that by supporting an increase in [Clean Water Indiana] funds.”

If approved, the increase would be written into the state budget through House Bill 1001.

Its supporters include Tonya Pfaff, who represents Terre Haute and District 43 in the Indiana House of Representatives.

“One of the reasons we have a robust [state budget] surplus in Indiana is critical priorities, like clean water projects, have been underfunded for the last two decades,” Pfaff said Wednesday via email, referencing the state government’s \$6.1-billion surplus.

“We need to use part of the surplus to start addressing these critically important areas of concern,” Pfaff added. “Making sure everyone has clean water is something we all should all be able to get behind. I support this effort to increase the funding to the Clean Water Indiana fund.”

Zimmerman is working to inform every state legislator about the needs for better conservation funding. He’s hopeful about a cause that prompted him to “come out of retirement” to help lead.

“I’ve spent a good part of my adult life pursuing conservation for the sake of the resources,” Zimmerman said, “and I feel compelled to spend my time doing something important and meaningful.”

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\$10M USDA grant targets more Midwestern seafood production and consumption

WEST LAFAYETTE, Ind. — Purdue University has received a five-year, \$10 million grant from the U.S. Department of Agriculture to increase the production of seafood, also known as “blue food,” which is healthier and more sustainably produced than land-based foods.

“Many studies indicate the importance of increasing seafood consumption in U.S. diets,” said Jen-Yi Huang, project director and associate professor of food science at Purdue University. Those studies show that seafood can boost intake of healthy omega-3 fatty acids, vitamins and minerals while also reducing more harmful substances such as cholesterol and saturated fat.

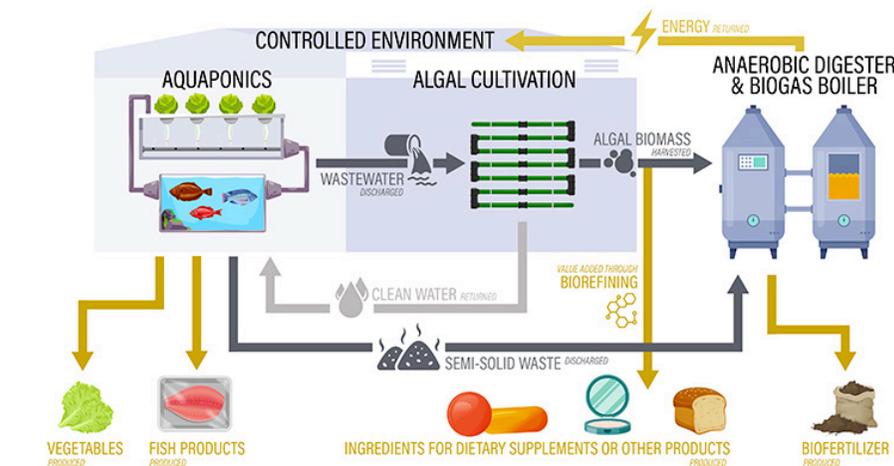
A 2021 blue food assessment published in the journal *Nature* found that a 15.5-million-ton increase in aquatic animal-source food by 2030 would decrease the price of such food by 26%. The resulting increase in blue food consumption would result in preventing an estimated 166 million cases of inadequate intake of micronutrients such as vitamin A, calcium and iron worldwide.

Seafood is readily available in local grocery stores, but most of it is imported from Asia and elsewhere. Such long-distance supply chains recently have proven vulnerable to volatile markets, fluctuating fuel costs, the COVID-19 pandemic and regional war, said Huang, who also holds a courtesy appointment in Environmental and Ecological Engineering.

About 90% of U.S. seafood comes from abroad, resulting in a \$17 billion trade deficit. U.S. fisheries are not sustainable because of overfishing concerns, Huang noted. Aquaculture — growing aquatic organisms under controlled conditions — offers an alternative.

Aquaponics is a combination of aquaculture and hydroponics (growing plants in water) that offers the advantage of intensively producing seafood and plants using less land and water than conventional food production.

The Midwest especially could benefit from aquaponics. The region suffers high



obesity rates, operates the fewest aquaculture farms and consumes the least amount of seafood.

“It can increase production yields, but aquaponics production hasn’t been widely adopted, especially in the Midwest,” Huang said. Energy use in the required greenhouse environment is one key reason.

Aquaponics operations require the daily discharge of up to 20% of wastewater into the environment. For large farms, that becomes a maintenance cost because they need permits to treat their wastewater before discharge.

“The smaller farms don’t need permits,” Huang said. “They can discharge whatever they generate, which can cause environmental issues.”

With the USDA funding, Purdue researchers will build a pilot-scale integrated aquaponics system on campus, where some lab-scale components already exist, to produce tilapia and lettuce.

Purdue researchers will build a pilot-scale integrated aquaponics system on campus to produce tilapia and lettuce. This zero-waste food production system will convert nutrient-rich waste into energy for system operation and high-value bioproducts.

Paul Brown, professor of forestry and natural resources, operates experimental aquaponics systems in the Aquaculture Research Lab. Halis Simsek, assistant

professor of agricultural and biological engineering, maintains bioreactors in his laboratory for algae cultivation. Jiqin Ni, professor of agricultural and biological engineering, works with anaerobic digesters, which use microorganisms to break down biodegradable matter in an oxygen-free environment.

Additional Purdue researchers collaborating on this research are Natalie Carroll, professor of agricultural sciences education and communication and agricultural and biological engineering; Abigail Engelberth, associate professor of agricultural and biological engineering and environmental and ecological engineering; Betty Feng, assistant professor of food science; Andrea Liceaga, associate professor of food science; Lindsey Payne, assistant professor of environmental and ecological engineering; Kwamena Quagraine, professor of agricultural economics and forestry and natural resources; and George Zhou, associate professor of civil engineering and environmental and ecological engineering.

Also on the team is Nicole Wright, aquaculture extension educator at The Ohio State University.

“Algae cultivation and anaerobic digestion are two of the most important components in Purdue’s integrated aquaponic system,” Ni said. “We use the algae to treat the wastewater and also anaerobic digestion to treat the algal

biomass and other waste streams like fish processing wastes.”

The Purdue system will direct the aquaponics wastewater discharge into algal bioreactors, where algae can feed on its nutrients. The next step is anaerobic digestion, which generates biogas fuel as one of its products.

“That energy can be sent back to the aquaponics system to offset the energy requirement of the indoor facility operation, at least partially,” Huang said. The system is designed to generate zero waste and to operate independently of the power grid.

The system also includes a biorefinery subsystem to convert algae and fish by-products into high-value nutraceuticals such as bioactive peptide and phenolic compounds. The biorefinery can turn the algae into fish feed for the aquaponics operation as well.

“By integration with the biorefinery, we can have additional revenues for aquaponics farmers so that they can improve their economic viability,” Huang said. “We will develop multidimensional sustainability metrics for system assessment and management to make sure that this kind of integration is technically feasible, economically viable and environmentally friendly.”

The project will further include stakeholder education and outreach components. The research team will survey farmers and suppliers about the barriers and opportunities for blue foods and aquaponics. The team also will develop workshops to help interested farmers build aquaponics systems or improve their existing operations.

In addition, the grant will foster a workforce that can support blue food production by funding the creation of educational materials for high school, undergraduate and graduate students.

“We also want to educate consumers on the benefit of blue foods so that they can diversify their dietary pattern to include more blue foods and ultimately improve health,” Huang said.

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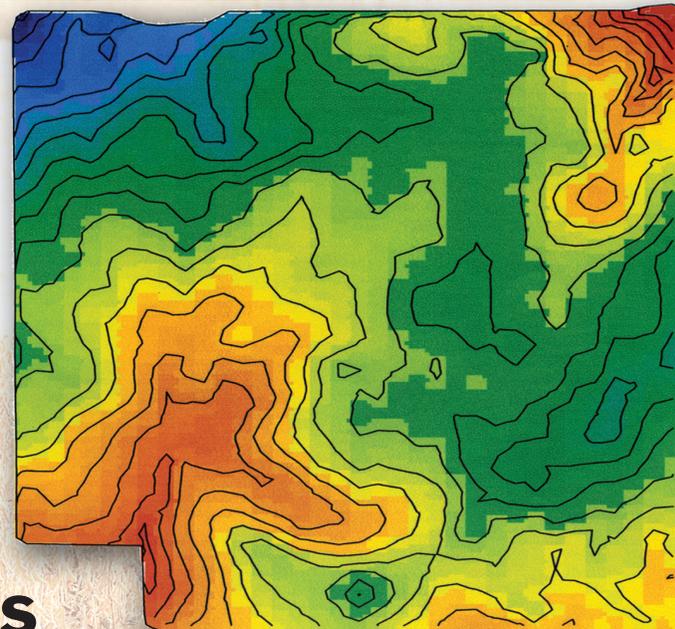
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New LED strategies could make vertical farming more productive, less costly

WEST LAFAYETTE, Ind. — Purdue University researchers have designed two simple LED lighting strategies to increase yield and reduce energy costs for the vertical farming sector of indoor agriculture.

The close-canopy and focused-lighting strategies developed by PhD candidate Fatemeh Sheibani and professor Cary Mitchell, both in the Department of Horticulture and Landscape Architecture in Purdue's College of Agriculture, capitalize on LED lighting's special properties.

"One is that they are relatively cool at the emitting surface, in contrast with other lighting choices," Sheibani said. Thus, the lighting system works closer to plants without scorching them. LEDs are also current driven, unlike many energy-intensive, voltage-driven lighting sources.

Their work is part of a project called OptimIA (Optimizing Indoor Agriculture). The project, led by Michigan State University, includes collaborators at Purdue, University of Arizona and Ohio State University. OptimIA is sponsored by the U.S. Department of Energy's Specialty Crop Research Initiative.

Fatemeh Sheibani, a PhD candidate in horticulture and landscape architecture, examines lettuce plants in a controlled environment chamber using LED lighting. Sheibani's research focuses on finding the best strategy for using LEDs in vertical farming that will maximize crop yield and decrease production costs associated with lighting.

"It is the fastest-growing sector of controlled-environment ag," Mitchell said. "There are new startups going on in urban and para-urban areas all the time, and worldwide."

Fueled by an enthusiastic investment sector, the U.S. is a worldwide industry leader. But labor and energy costs, totaling about 60% of running an indoor farm, threaten the startups' future. Inflation and rising energy costs have made an already fragile industry even more so. Startup costs are also high, both for land



in urban areas and for LED lighting system installation.

But indoor farms can easily lower energy use while achieving their usual yield with the close-canopy-lighting strategy. Or, they can increase yield while maintaining their previous energy use. Indoor farmers can dim the voltage of a 1,000-watt, high-pressure sodium lamp with a rheostat, but that merely turns the energy into heat without any savings.

"It's hidden energy," Mitchell said. But with the LEDs, the current flow can be reduced, and light output is reduced proportionally.

Close-canopy lighting works because LEDs shine in all directions, like the sun. At standard plant/light separation distances, significant light streaming at wide angles over the plants misses them entirely. But with reduced separation distances, the plants absorb light that would otherwise go to waste.

Michael Gildersleeve, a graduate student in Purdue's Department of Horticulture and Landscape Architecture, works with lettuce plants grown under close-canopy LED lighting to maximize energy efficiency and crop yield. (Purdue Agricultural Communications photo/Tom Campbell) Download image

Today, indoor farms can affordably offer only leafy greens and culinary herbs to

consumers. Their quick growth allows for many cropping cycles year-round, unlike produce grown in gardens or fields.

And once they reach high-cost urban areas, indoor-produced salad kits and leafy greens might sell for \$16 or \$17 a pound.

"What they sell you in the store in a clamshell or as an individual plant is just a fraction of a pound," Mitchell said.

LEDs are the lighting system of choice for indoor farming because of their relative energy efficiency and long lifetimes, Sheibani said. But improved LEDs also have high photon efficacy, meaning that electric energy is more readily converted to light that plants can use efficiently.

Still, inefficient capture of LED light reduces their benefits. Many indoor farmers, for instance, mistakenly believe that they can place their LEDs anywhere. But Sheibani and Mitchell noticed both in vertical farms and in smaller-scale experiments that the light fell not only on the plants but also on the walls and walkways. By reducing the distance between the LED system and the leaf canopy, the researchers were able to reduce such wasted light.

"We can improve canopy photon capture efficiency, as we call it, as long as we use LEDs correctly," Sheibani said. "Canopy photon capture efficiency is the

fraction of photons that reach the photosynthesizing machinery of the plants."

Sheibani measures waste via a ratio of plant growth to LED electrical energy consumption. The resulting energy utilization efficiency compares grams of fresh or dry biomass yield per kilowatt hour of energy consumed by the LED lighting system.

"The higher the grams of fresh or dry biomass produced per kilowatt hour, the better it is," she said. And both of Purdue's tested scenarios found that the closest separation distance had the highest energy utilization efficiency.

Sheibani and Mitchell also are testing an energy-saving, focused-lighting approach that relies on a custom-made LED system with selective controls. How do small, individual, widely separated plants fare under slowly spreading beams of light rather than full coverage all the time?

"When seedlings emerge after germination, the very small plants are wide apart," Mitchell said.

"It takes two weeks for them to grow together and close a canopy of baby greens. Everything in between is mostly wasted light until then."

Sheibani and Mitchell's system minimizes that waste. When plants are still small, they use full-coverage LED lighting inefficiently, Sheibani said. But it is possible to save energy in the earlier growth stages with focused lighting.

"Then when the plants are at the stage that they can use light efficiently, we can upgrade to provide the optimum amount," she said.

OptimIA offers more information in free video presentations at OptimIAUniversity and the Indoor Ag Science Café.

"There's a lot of excitement about indoor ag and people are jumping into it," Mitchell said. "But they don't really have the secret for long-term profitability yet. That's where academic research such as the OptimIA project comes in to help."

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2022 was another record year for U.S. farm exports

WASHINGTON - The American agricultural sector posted its best export year ever in 2022 with international sales of U.S. farm and food products reaching \$196 billion, Agriculture Secretary Tom Vilsack announced today. Final 2022 trade data released earlier this week by the Commerce Department shows that U.S. agricultural exports increased 11 percent, or \$19.5 billion, from the previous record set in 2021.

"This second consecutive year of record-setting agricultural exports, coupled with a record \$160.5 billion in net farm income in 2022, demonstrates the success of the Biden-Harris Administration's efforts to create new and better markets for America's agricultural producers and business-

es," Vilsack said. "We're strengthening relationships with our trading partners and holding those partners accountable for their commitments. We're making historic investments in infrastructure to strengthen supply chains and prevent market disruptions. We're knocking down trade barriers that hamper U.S. producers' access to key markets. And we're continuing to invest in export market development programs, partnering with industry to bring high-quality, cost-competitive U.S. products to consumers around the world."

The value of sales increased in all of the United States' top 10 agricultural export markets - China, Mexico, Canada, Japan, the European Union, South Korea, Taiwan, the Philippines,

Colombia and Vietnam, with sales in seven of the 10 markets (China, Mexico, Canada, South Korea, Taiwan, the Philippines and Colombia) setting new records.

"While we remain committed to our established customer base around the world, we are also setting our sights on new growth opportunities in places like Africa, Latin America, the Middle East and Southeast Asia. Overall, there were 30 markets where U.S. exports exceeded \$1 billion in 2022 - an increase from 27 markets in 2021 - demonstrating the broad global appeal of American-grown products," Vilsack noted.

The top commodities exported by the United States in 2022 were soybeans, corn, beef, dairy, cotton and

tree nuts, which together comprised more than half of U.S. agricultural export value. International sales of many U.S. products - including soybeans, cotton, dairy, beef, ethanol, poultry, soybean meal, distilled spirits and distillers' grains - reached record values.

"At the end of the day, agricultural trade is all about opportunities - for America's farmers and ranchers, for our rural communities, for the U.S. economy and for our global customers. We extend our gratitude to the Americans across the agricultural industry who create and support those opportunities by growing, processing, selling and shipping our farm and food products to the world," Vilsack said.

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