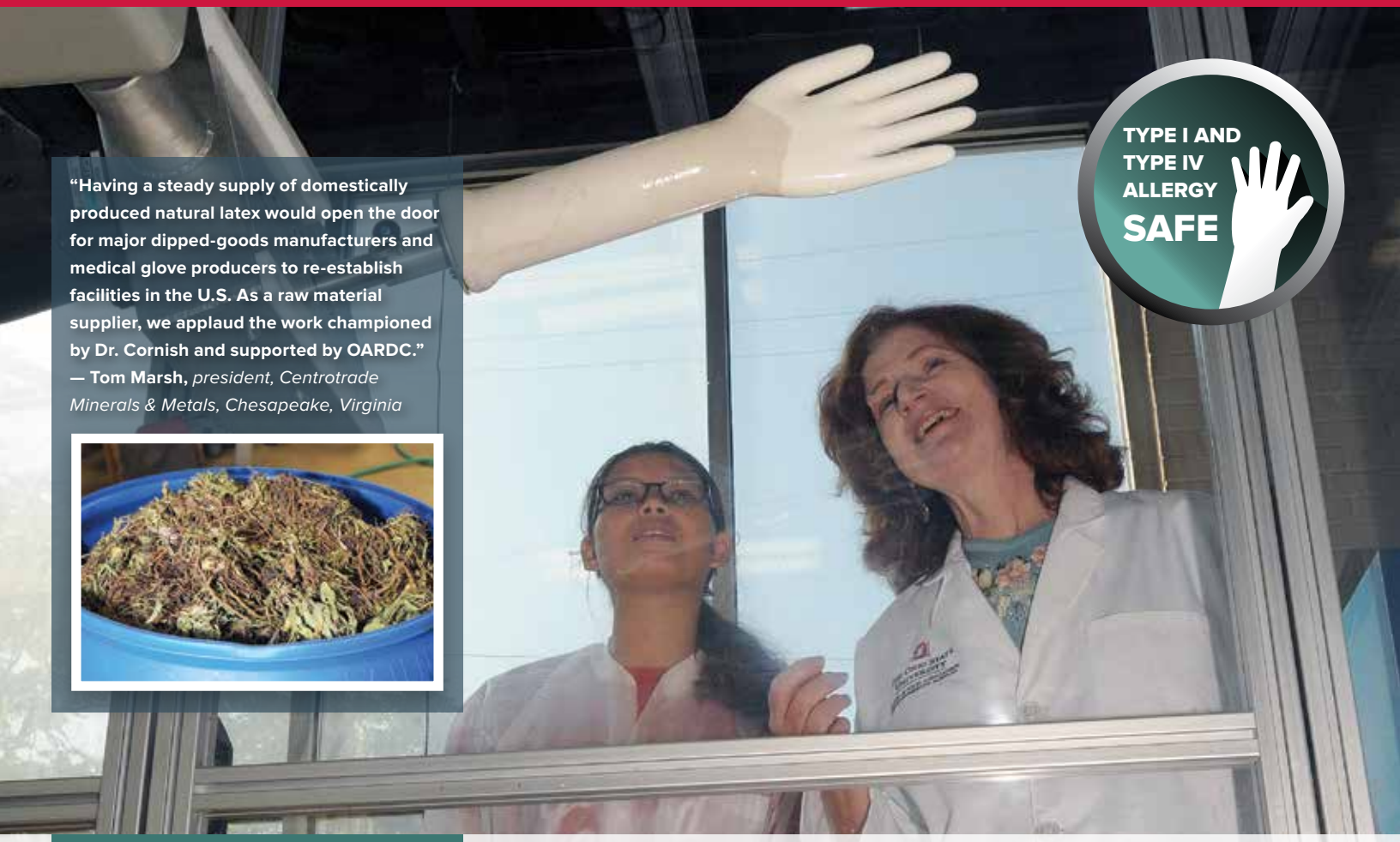

"Having a steady supply of domestically produced natural latex would open the door for major dipped-goods manufacturers and medical glove producers to re-establish facilities in the U.S. As a raw material supplier, we applaud the work championed by Dr. Cornish and supported by OARDC."
— Tom Marsh, *president, Centrotrade Minerals & Metals, Chesapeake, Virginia*

Graduate student Cindy Barrera Martínez (left) and researcher Katrina Cornish make latex gloves for testing at OARDC's alternative rubber pilot plant in Wooster.

ESSENTIALS

- Medical professionals prefer natural rubber latex gloves over synthetic ones because they are stronger, have more tactile sensitivity, provide superior protection to blood-borne pathogens and cause less hand fatigue.
- Latex is also the preferred material for many healthcare and consumer products such as catheters, masks, dental dams, orthodontic rubber bands and condoms.
- The Ohio State University is conducting guayule trials in southern Ohio with the aim of developing a new domestic rubber-and-latex-producing crop as well as economic opportunities in the region.
- Cornish is also working with partners in South Africa to grow guayule there and to produce allergy-free condoms, empowering poor women to start their own enterprises while helping to combat the AIDS epidemic.
- A startup company — EnergyEne Inc., headquartered in Wooster — has been established to lead the development and commercialization of products made from these new latex materials.

New hypoallergenic latex creates business opportunity

Ohio Agricultural Research and Development Center researchers have developed new materials that will allow medical professionals to have the natural latex gloves they prefer, while avoiding the risk of allergic reactions.

The patent-pending materials include a latex film made from guayule that is safe for both Type I and Type IV latex allergy sufferers, and a traditional Hevea rubber tree latex film that is Type IV-hypoallergenic.

"Guayule is a U.S. desert shrub that produces a high-quality latex which is very strong, tear-resistant, soft, comfortable and less irritating than synthetic materials from which many gloves are now made," said Katrina Cornish, The Ohio State University's Ohio Research Scholar and endowed chair in bioemergent materials. "And guayule latex is naturally Type I-hypoallergenic."

To make the guayule and Hevea gloves Type IV-hypoallergenic, Cornish and her graduate students used new "accelerators" — chemicals added to speed up the curing reactions and production of latex products — that don't leave residues associated with this type of allergy in the finished product.

More: **go.osu.edu/nk3**

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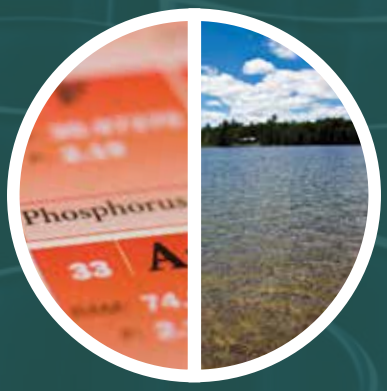
Food Security, Production, and Human Health



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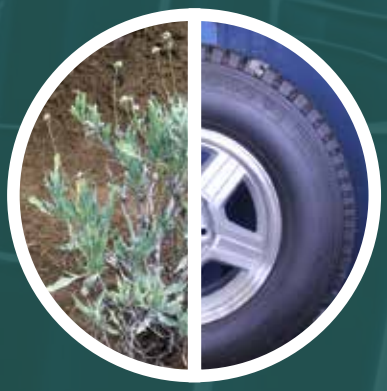

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OARDC studies bee colonies to learn more about factors affecting bee health. Healthy bees are crucial for both agricultural production and the environment.

Healthy bees, healthy agriculture: Striking a balance

"Ohio State University research is required to provide information to the Ohio agriculture community, which will allow collaboration between beekeepers and farmers to help each other keep honeybees healthy and safe, and provide the pollination needed to keep crop production sustainable and profitable." — Dwight Wells, *regional director, Ohio State Beekeepers Association*

Bees are crucial to agriculture and food security. They pollinate about one-third of the crops we eat, valued at more than $14 billion annually in the U.S.

However, this valuable resource is at risk. During the 2013–2014 winter alone, Ohio beekeepers lost 50–80 percent of their honeybees. Bees are dying in large numbers due to many reasons, including diseases, insect pests, loss of habitat and agricultural chemicals.

"Most corn seeds planted today are coated with insecticides, and when they are chipped off in the planter, the dust lands on nearby flowers," said entomologist Reed Johnson. "Bees then carry the tainted pollen back to their hives, where young members of the colony become exposed to it."

Johnson is studying the unintended consequences of these insecticides as well as strategies to protect bees. For example, he has tested a lubricant that is applied to the seed to reduce dust, which shows promise in field trials.

More: **u.osu.edu/beelab**

ESSENTIALS

The Ohio Agricultural Research and Development Center and Ohio State University Extension work together with the beekeeping industry and others to deliver the following programs, which promote healthy bees and environments that boost bee numbers.

- A monthly webinar series is attended by some 120 beekeepers from Ohio, other states and several countries. It focuses on ways to monitor for health issues and combat pests that attack bees. The sessions are archived online and reach many more beekeepers.
- Monthly face-to-face educational programs with beekeeper associations throughout Ohio deal with topics such as integrated pest management and creating forage habitats for bees.
- A statewide network of 28 research and demonstration gardens were planted in 2014 at schools, parks, arboreta and OSU Extension offices. The gardens evaluate which combinations of plants attract bees most, so that recommendations can be made to help enhance their habitats.

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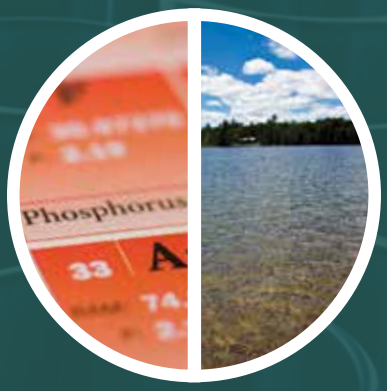

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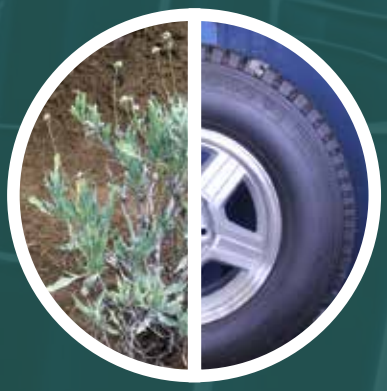

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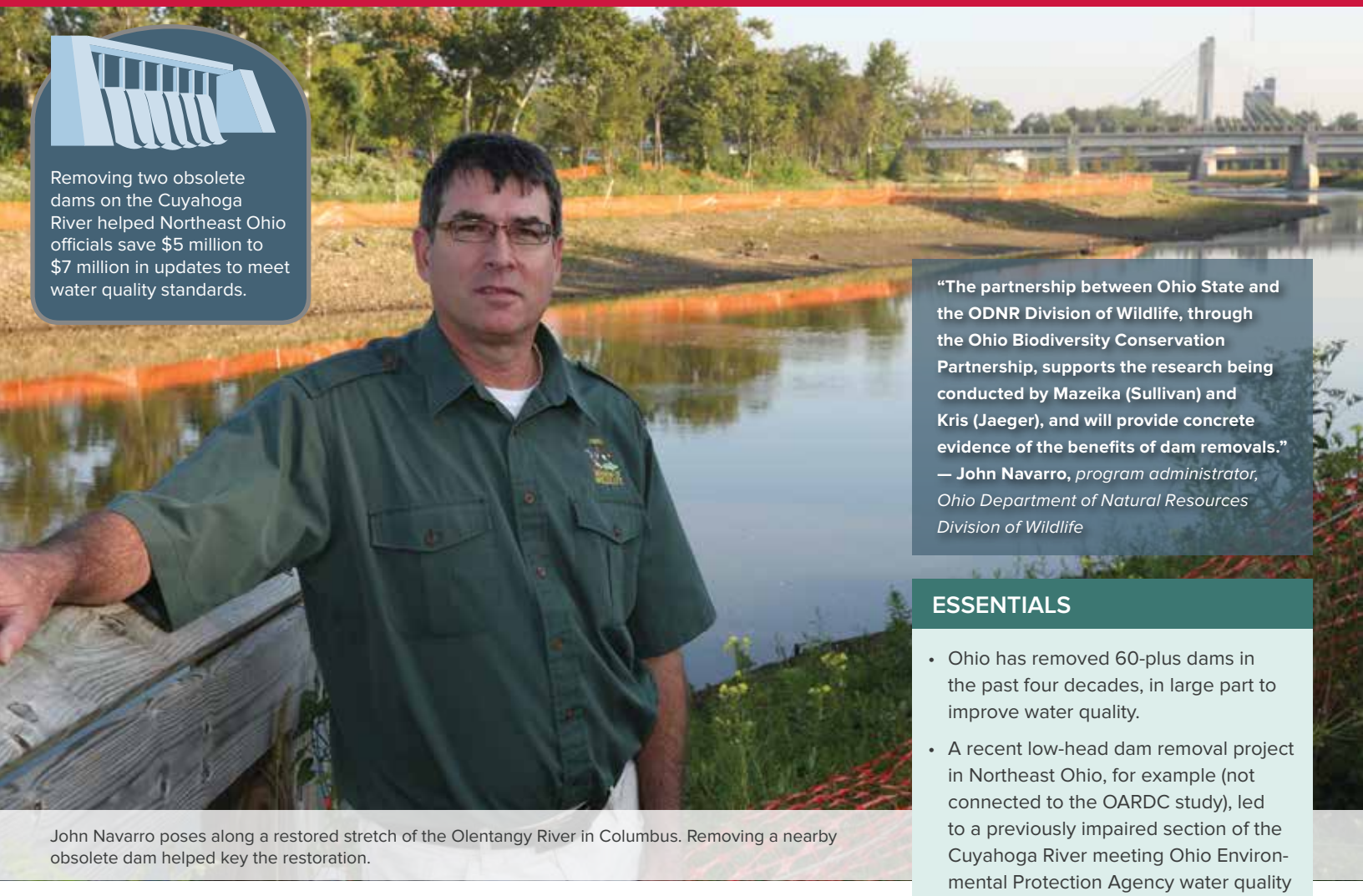

Removing two obsolete dams on the Cuyahoga River helped Northeast Ohio officials save $5 million to $7 million in updates to meet water quality standards.

"The partnership between Ohio State and the ODNR Division of Wildlife, through the Ohio Biodiversity Conservation Partnership, supports the research being conducted by Mazeika (Sullivan) and Kris (Jaeger), and will provide concrete evidence of the benefits of dam removals."
— John Navarro, *program administrator, Ohio Department of Natural Resources Division of Wildlife*

John Navarro poses along a restored stretch of the Olentangy River in Columbus. Removing a nearby obsolete dam helped key the restoration.

Showing the benefits of tearing down dams: Healthier rivers, cleaner water

Tear down a dam, and a river will change. But how? And how much? To find out, Ohio Agricultural Research and Development Center scientists are looking in their own backyard.

Mazeika Sullivan and Kristin Jaeger are studying the impacts of dam removals at two former dams in Columbus: one on the Olentangy River on The Ohio State University's Columbus campus, and another close by on the Scioto River. They're documenting the exact changes seen in the rivers' flow, biology and water quality.

"There's a growing trend toward using dam removal to restore rivers, but studies documenting the rivers' responses are limited," said Sullivan.

"It's logical to assume that removing a dam and restoring a river back to its natural state would provide an ecological boost," said study sponsor John Navarro, program administrator with the Ohio Department of Natural Resources Division of Wildlife. "But until now, there have been few studies that quantify these benefits."

More: **go.osu.edu/RiverRestoration**

Mazeika Sullivan

Kristin Jaeger

ESSENTIALS

- Ohio has removed 60-plus dams in the past four decades, in large part to improve water quality.
- A recent low-head dam removal project in Northeast Ohio, for example (not connected to the OARDC study), led to a previously impaired section of the Cuyahoga River meeting Ohio Environmental Protection Agency water quality standards within just six months — with fish diversity going up by 57 percent.
- Dam removal cools a river's water — about 6 degrees Fahrenheit in a previous study in Michigan — and restores its natural temperature range.
- The improved water flow from dam removal keeps sediment from building up. Dam sediment can be full of accumulated toxins, including health threats such as polychlorinated biphenyls (PCBs).
- Sullivan and Jaeger's research is partly funded by a grant from the National Science Foundation.

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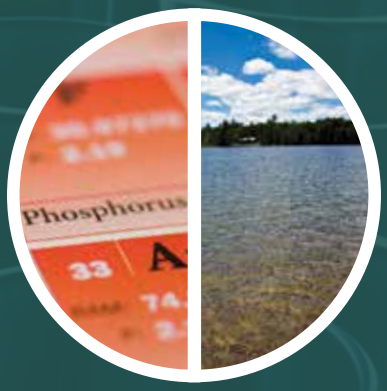

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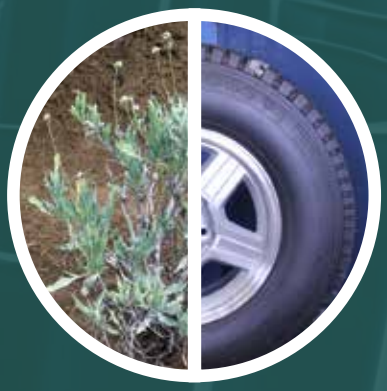

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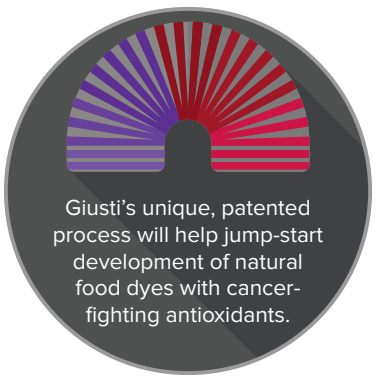
Neda Ahmadiani and Greg Sigurdson, Ph.D. students in Giusti's lab, examine anthocyanins' chemical structures and stability in various applications.

"Monica Giusti's work is both cost-effective and innovative — a powerful combination that's attractive to industry partners. Companies are working with Ohio State not only to fund her research but to commercialize it as well." — Melissa Kelly, *licensing manager, The Ohio State University Technology Commercialization Office*

Colorful anthocyanins offer health benefits and a natural alternative for use as food dyes. Monica Giusti's innovations could accelerate research and development in the field.

ESSENTIALS

- Giusti's anthocyanins research has garnered more than $500,000 in private industry support since 2009. The result: two patents, with five more pending.
- Guisti was named The Ohio State University's Early Career Innovator of the Year in 2013, and is co-editor of "Anthocyanins in Health and Disease," the first book to summarize advances in research of anthocyanins' role in disease prevention.
- Giusti is a member of CAFFRE, the Center for Advanced Functional Foods Research and Entrepreneurship, which focuses on developing health-promoting functional foods and ingredients. CAFFRE combines efforts of 44 university scientists and has resulted in 250-plus collaborative research publications and a total of $18 million in support related to foods, nutrients and health between 2006–2014, including $2 million from 21 industry partners: **fst.osu.edu/caffre**.



Giusti's unique, patented process will help jump-start development of natural food dyes with cancer-fighting antioxidants.

Opening doors for new research into cancer-fighting food dyes

Monica Giusti's lab budget wasn't limitless. And the anthocyanins she studied weren't cheap. So she made her own — slashing costs 10- to 20-fold. Now, her patented process will be commercialized by newly formed Anthocyantific LLC. Giusti is chief scientist.

Anthocyanins are powerful antioxidants that also give color to most red, orange, purple and blue fruits and vegetables. Giusti is internationally known for her research on their potential as cancer-fighters and as natural food dyes.

"Most companies sell anthocyanin standards, one anthocyanin at a time. And only a small portion of the 700 anthocyanins known to exist is available as pure standards," Giusti said. "What we produce is unique."

The process provides a complete blend of anthocyanins from specific foods: the single primary anthocyanin from strawberries, for example, or the 15-plus anthocyanins from blueberries. Giusti hopes the new products' availability and low cost will galvanize new research into the pigments.

More: **go.osu.edu/colorcodes**

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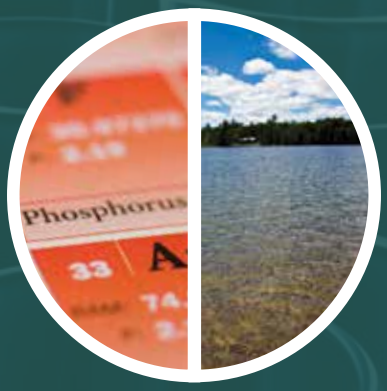

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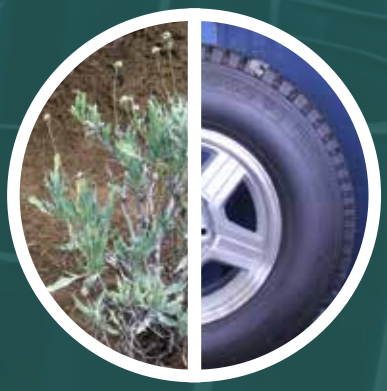

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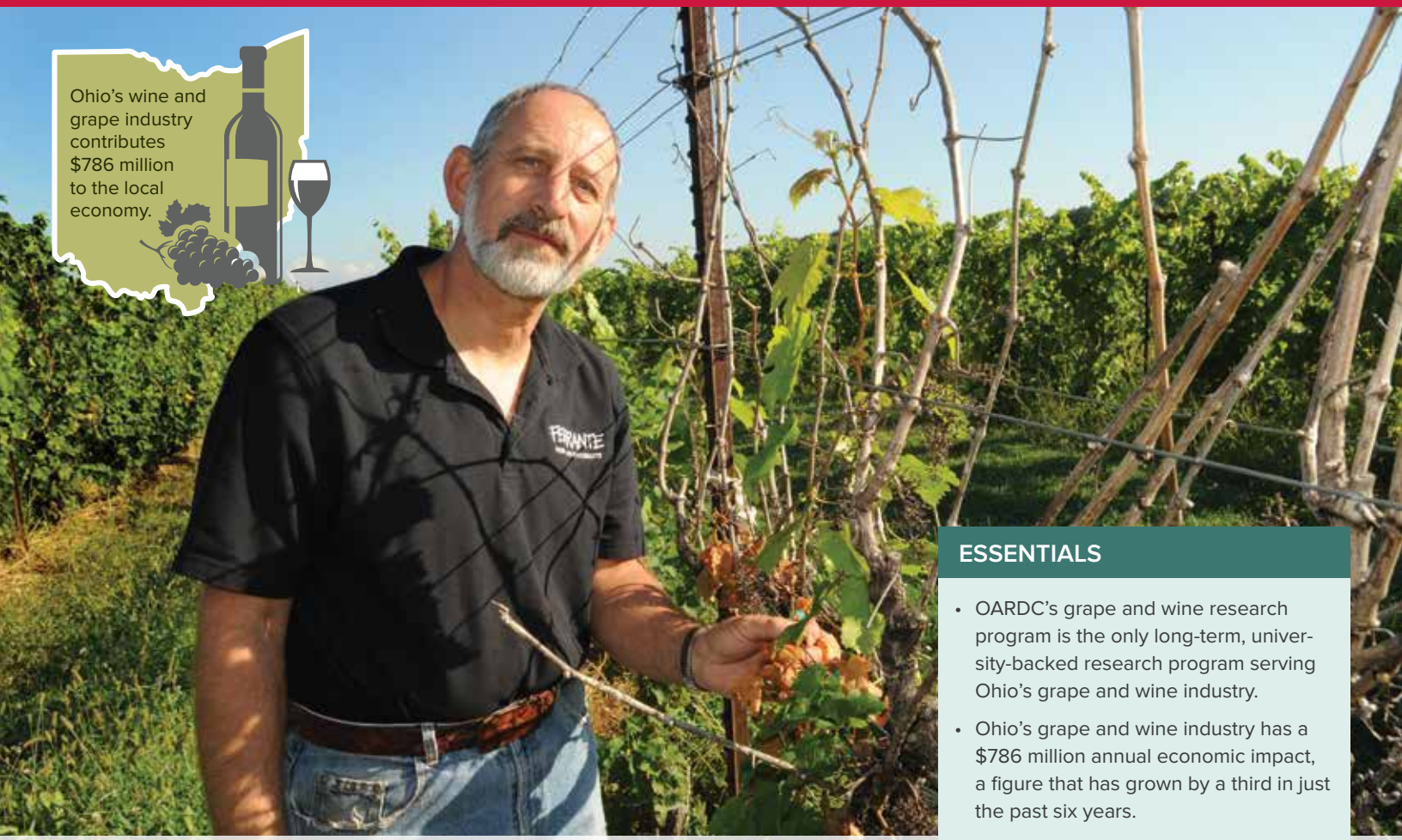


Nick Ferrante checks his vineyards in Ashtabula County. The winter of 2013-14 devastated his crop. But OARDC research offers hope for recovery.

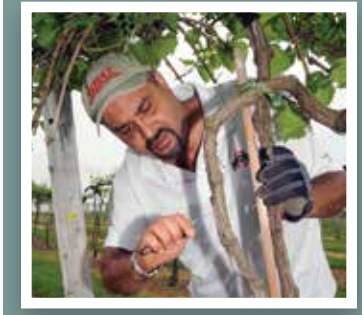
Serving, growing Ohio's grape and wine industry

The "polar vortex" winter of 2013–2014 hit Ohio's wine grapes hard. Nick Ferrante knows it. The owner of Geneva's Ferrante Winery lost his entire 2014 vinifera crop. And he wasn't alone. Ohio grape growers estimated their vinifera losses at 97 percent, and officials expected damage to all the state's grape varieties to top $12 million. Vinifera, or European, grapes go into such wines as Chardonnay.

"This was probably the worst grape damage on record in Ohio," said Imed Dami, who works to help growers recover from that damage and reduce or prevent it in the future.

As leader of the Ohio Agricultural Research and Development Center's viticulture, or grape-growing, research, Dami studies, for example, new grape varieties' cold hardiness and how to prune winter-damaged vines. Then he shares his findings for growers to use — a sustained flow of new science-based knowledge that Ferrante calls "a great asset to the industry."

More: **go.osu.edu/GrowingGrapes**



Imed Dami

"Imed Dami's research has impacted all of Ohio's vineyards, especially in the Grand River Valley, which produces some of the state's finest vinifera wines and has won many prestigious awards. We've used many of Imed's strategies to improve vine health, yields and wine quality." — Nick Ferrante, *owner, Ferrante Winery, Geneva, Ohio*

ESSENTIALS

- OARDC's grape and wine research program is the only long-term, university-backed research program serving Ohio's grape and wine industry.
- Ohio's grape and wine industry has a $786 million annual economic impact, a figure that has grown by a third in just the past six years.
- The industry created 1,200 new jobs during that growth and now supports more than 5,000 full-time jobs.
- Following last winter's devastation, Dami has taught an ongoing statewide workshop series on pruning winter-damaged vines. The goal is to return Ohio grape growers to full production as soon as possible.
- Dami and colleagues do extensive research on improved grape production methods. Field trials take place in Wooster, at OARDC's Ashtabula Agricultural Research Station in Kingsville and in vineyards of cooperating growers.
- Dami has attracted nearly $3.4 million in grant support from industry and others since 2008.

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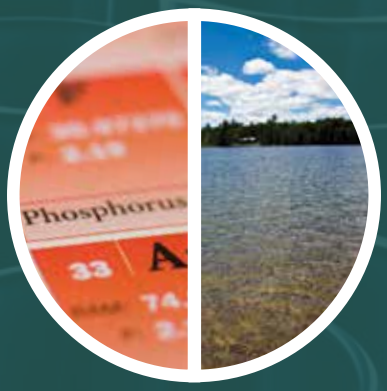

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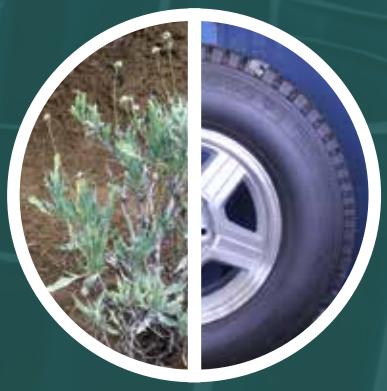

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"It is increasingly important that we have a high-quality swine research capability in Ohio. We, as swine producers, need this information as soon as possible to help us manage diseases such as PEDv the best we can to limit severe economic losses." — Pat Hord, *owner, Hord Livestock Company, Bucyrus, Ohio*

"PEDv is not likely to just go away. We need to develop vaccines that can protect pigs that have never been exposed to the disease before." — Qiuhong Wang, virologist, OARDC

Young pigs are the most vulnerable to PEDv. Because new virus strains continue to appear, research to develop effective vaccines is crucial to fight the disease.

ESSENTIALS

- PEDv has killed more than 7 million piglets in the U.S., reducing pork production and threatening to impact the availability of pork products as well as prices.
- OARDC is one of the few facilities nationwide that has been able to grow PEDv in the lab, allowing researchers to have enough virus material to develop diagnostic tests and vaccine candidates.
- Ohio State University researchers are collaborating with a large animal health company to develop PEDv vaccines.
- OARDC animal disease research is supported by its unique germ-free animal labs, where new diseases and treatments can be tested in isolation; and by its Plant and Animal Agrosecurity Research facility, the only lab in Ohio and one of only two nationally with capacity for plant and animal disease research at the BSL-3 biosafety level.

Tackling a new swine disease and its economic impact

In 2013, a new swine disease showed up in the U.S. Very quickly, porcine epidemic diarrhea virus (PEDv) spread across the country, killing 50–100 percent of piglets at hundreds of farms in at least 30 states, including Ohio. With funding from the National Pork Board, Ohio Agricultural Research and Development Center scientists are conducting research to answer crucial questions about and develop effective tests and vaccines against PEDv.

Qiuhong Wang

"Our studies show that the PEDv strains circulating in the U.S. are more aggressive than the strains from Europe," OARDC virologist Qiuhong Wang said. "In the U.S., it doesn't look likely that PEDv will stop mutating and that herds will become endemic and experience little mortality."

Scientists in Wang's and Linda Saif's labs grew the virus in cell culture and are using this material to develop a "booster" vaccine that can protect pigs previously exposed to PEDv. The end goal is to develop a stronger vaccine that can also protect swine with zero immunity to the virus.

More: **go.osu.edu/nkx**

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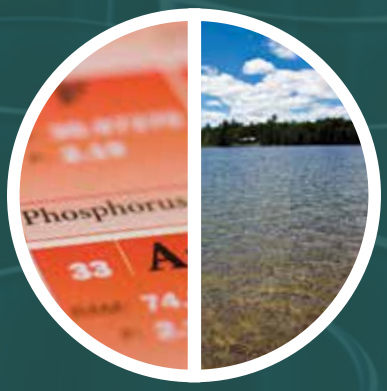
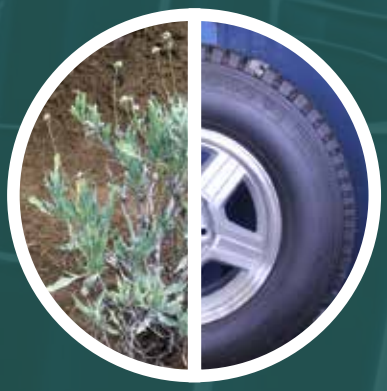


Environmental Quality and Sustainability



Advanced Bioenergy and Biobased Products

Ohio Agricultural Research and Development Center

As the research arm of The Ohio State University's College of Food, Agricultural, and Environmental Sciences (CFAES), the Ohio Agricultural Research and Development Center (OARDC) employs nearly 650 scientists and staff members throughout the state.

Ohio State's Wooster campus is the largest agbioscience research facility in the U.S. OARDC scientists work closely with researchers in Ohio State's Colleges of Education and Human Ecology, Medicine, Public Health, Veterinary Medicine, Biological Sciences and Engineering.

At any given time, OARDC researchers are engaged in nearly 400 research projects. Primary focus is in three signature areas:

- Advanced Bioenergy and Biobased Products
- Environmental Quality and Sustainability
- Food Security, Production, and Human Health

The Ohio General Assembly established OARDC as the Ohio Agricultural Experiment Station in 1882. It is supported by a line-item appropriation from the Ohio General Assembly, competitive grants, gifts, contracts, federal grants and other sources. OARDC uses these funds to provide direct research support and economic development for Ohio's annual $100+ billion agbioscience industry. OARDC is not funded by student tuition or any other general funds of The Ohio State University.

OARDC

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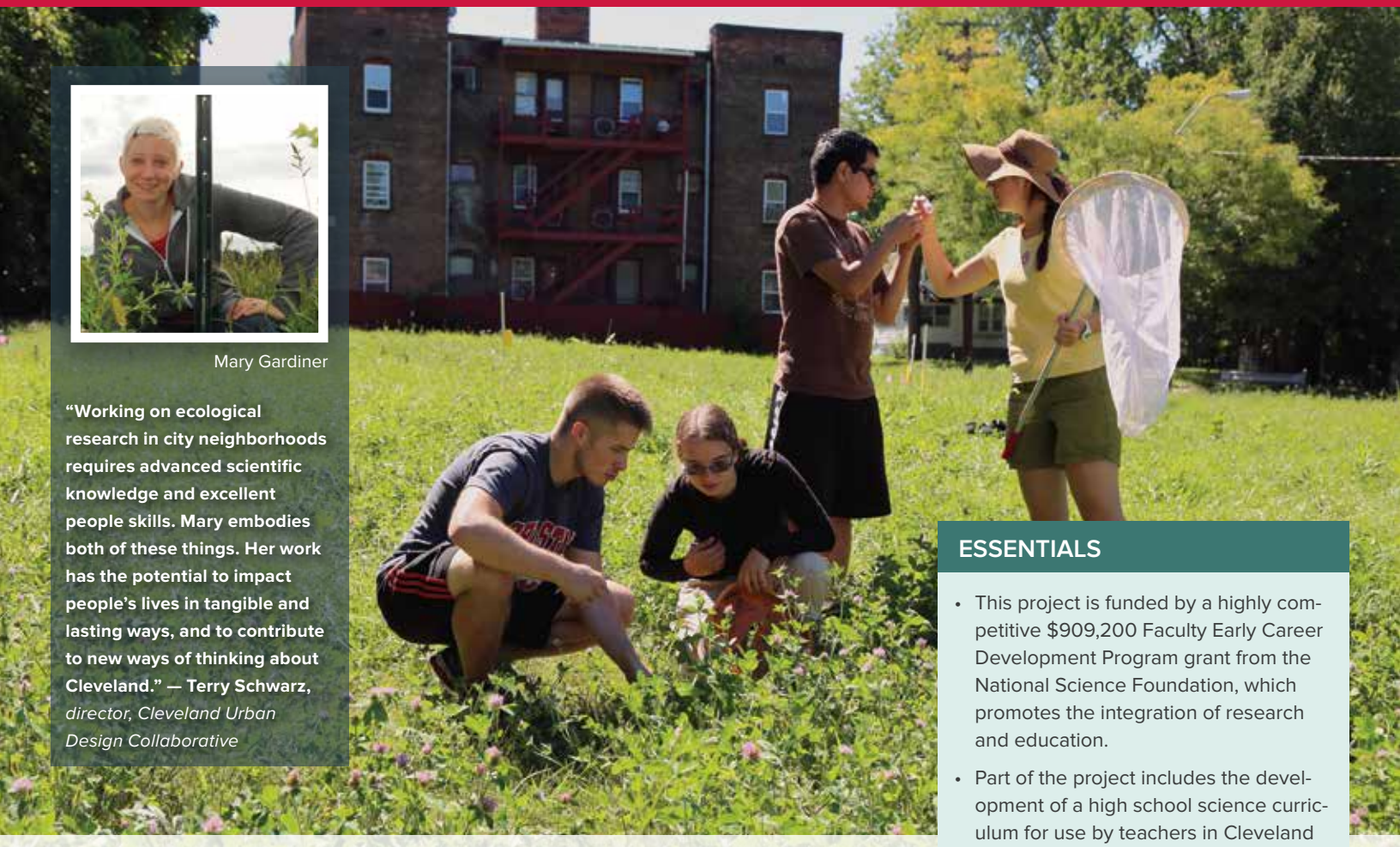
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES



Mary Gardiner

"Working on ecological research in city neighborhoods requires advanced scientific knowledge and excellent people skills. Mary embodies both of these things. Her work has the potential to impact people's lives in tangible and lasting ways, and to contribute to new ways of thinking about Cleveland." — Terry Schwarz, *director, Cleveland Urban Design Collaborative*

Graduate students in Mary Gardiner's lab survey vacant lots in Cleveland to determine the environmental benefits of different landscape treatments being studied.

Land of opportunity: Cleveland empty lots yield environmental benefits

Decades of population losses have left the city of Cleveland with 3,600 acres of vacant land, while some 1,000 homes are demolished every year.

Currently, Cleveland plants turfgrass on empty lots, but it's expensive to maintain and offers few benefits. "Alternative plant communities could offer greater environmental benefits such as support of biodiversity and improved storm-water infiltration to reduce flooding," said Ohio Agricultural Research and Development Center entomologist Mary Gardiner.

Community members and city leaders are partners in this project, providing input about their landscape treatment preferences.

Last year, Gardiner started a large-scale, never-before-attempted project that examines the impact of eight different landscape treatments on the biodiversity and ecosystem function of 64 empty lots in eight Cleveland neighborhoods. The five-year project's main goal is to gather data that will inform future green space design in Cleveland and other cities engaged or interested in vacant-land management.

"With the right combination of plants and increased ecosystem services, urban vacant land can be seen as an asset for community development rather than as an eyesore," Gardiner said.

More: **ale.cfaes.ohio-state.edu/home**

ESSENTIALS

- This project is funded by a highly competitive $909,200 Faculty Early Career Development Program grant from the National Science Foundation, which promotes the integration of research and education.
- Part of the project includes the development of a high school science curriculum for use by teachers in Cleveland and throughout the state. The lessons focus on insect-predator-prey relationships and teaching students how to collect data and communicate their findings using scientific arguments.
- A related program involves the training of Master Gardener volunteers on issues related to urban farming. These volunteers will then teach Cleveland residents best practices for growing fruits and vegetables on converted vacant land, fostering new economic opportunities and healthier eating.
- Students in Gardiner's lab are also studying the benefits of rain gardens in the city of Cleveland, including their contributions to pollinators, soil health and storm-water cleanup.

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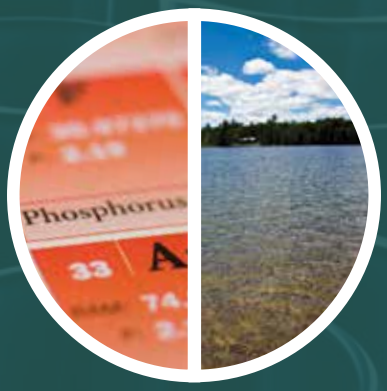
OARDC: A Leader in Agbioscience

ag•bi•o•sci•ence (ăg'bī'ō-sī'ens) *n.* the integration of scientific disciplines to address critical needs of food security, safety and health; environmental sustainability; and biobased energy, fuel and products

Food Security, Production, and Human Health



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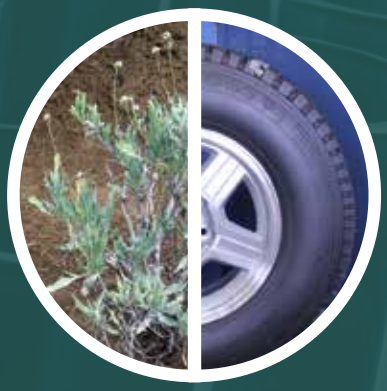

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