



# futures

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## LAKE EFFECT

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**Research in Michigan  
reaps great rewards**



## I ♥ MICHIGAN!



LEFT: The historic D.H. Day Farm barn in the Sleeping Bear Dunes National Lakeshore, near Glen Arbor.

I feel fortunate to have been raised in Michigan and to have spent countless vacations within the Great Lakes State. Growing up here, I enjoyed summer trips north to swim in the clear waters, fish the lakes, hike the wooded trails and search the sandy shores for Petoskey stones. Now, I also cherish picnics and bonfires on the beach with family and friends watching the waves rush in. Preferably with a glass of Michigan wine.

This past summer, we rented a cottage in the heart of Glen Arbor — the home of the Sleeping Bear Dunes National Lakeshore and the place that *Good Morning America* named the “Most Beautiful Place in America” in 2011. That prestigious distinction, combined with the hugely successful Pure Michigan campaign, has helped create a bustling little town along Lake Michigan. During our weeklong stay, we spotted license plates from Vermont, New York, Nebraska, Missouri and New Mexico, and overheard accents from around the world. Local hot spot Art’s Tavern always seemed to have a line of customers waiting for a table morning, noon and night. Visitors also continually flocked through the doors of Cherry Republic, which offers a bounty of tasty samples from chocolate-covered dried cherries to cherry salsa. Despite its growing

popularity, Glen Arbor continues to exude quaint charm and loads of local flavor, including an amazing farmers’ market. Numerous other towns scattered throughout the state are reaping similar benefits from a thriving tourism industry.

In this issue of our magazine, we celebrate the splendor of the Great Lakes State. In addition to being a sought-after vacation destination, Michigan is a prime locale for research. The state’s unique topography, which varies from region to region, is ideal for agricultural production, as evidenced in Michigan’s ranking as the second most diverse agricultural state in the nation. The lake effect, rolling hills and sandy soils make for some of the finest fruits and vegetables around and a food and agriculture industry valued at more than \$94 billion per year. The need for research in food security, food production and sustainable growing practices has arguably never been higher.

Surrounded by some of the most expansive bodies of fresh water in the world, Michigan is also an ideal spot for aquatic research. In addition to the Great Lakes, experts are studying the inland rivers and lakes. Fisheries and wildlife is also a big focus, along with invasive species that threaten the industry and the environment. With

*The state’s unique topography, which varies from region to region, is ideal for agricultural production, as evidenced in Michigan’s ranking as the second most diverse agricultural state in the nation.*

forestland accounting for more than half of the state’s acreage, Michigan is also a fine place to study trees and shrubs. It is also home to numerous wildlife species (some 575 species of vertebrates have been recorded in Michigan) that make interesting topics for field research.

Our state is truly a magnificent specimen, not only in its physical beauty but in the research opportunities it naturally extends to scientists and future scientists. Because of the bounty of Michigan’s agriculture and natural resources industries, MSU faculty, staff members and students have a distinctly unique opportunity to conduct an array of hands-on experiments in some of the most picturesque and ideal locales possible.

We are proud to say that the MSU researchers and students featured in this edition of *Futures* are contributing to making our state an even better place in which to live, work, raise a family and visit. Although most Michiganders already realize the many splendors of our great state, it’s wonderful to see that message spreading across the globe.

**Holly Whetstone**  
Editor



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**ON THE COVER:** iStock photo taken on the Lake Michigan shoreline near Saugatuck, Michigan.





# The BIG CATCH

**Quantitative  
center is making  
every fish count**

**BY JAMES DAU**  
Communications Coordinator

From April until July, Michigan State University (MSU) AgBioResearch evolutionary ecologist **Kim Scribner** is more likely to be found wading with students in the evergreen-lined Black River of northern Michigan than in his campus office. The fisheries and wildlife professor studies lake sturgeon, a bottom-feeding Great Lakes fish species that can grow longer than 8 feet, weigh up to 300 pounds and live for nearly a century. Despite long lives, however, lake sturgeon populations have been in serious decline since the late 19th century. The U.S. Fish and Wildlife Service reports that in 1910, 80 percent of the species had disappeared from Lake Erie, and by 1929 the amount of sturgeon caught in Lake Michigan had dwindled from 3.8 million pounds to just 2,000. Numerous causes for the sturgeon decline are known. Scribner and his research team are trying to find a way to bring back the ancient fish.



BELOW: MSU AgBioResearch evolutionary ecologist Kim Scribner pauses along the bank of the Black River. Scribner's work on lake sturgeon, in cooperation with the Michigan Department of Natural Resources, is making important strides in keeping the ancient species afloat.



"Sturgeon migrate from the Great Lakes to the rivers for spawning, which makes them an important part of that coupled ecosystem," he said. "The species is a poster child for humans decreasing the population through overfishing and pollution, and we're trying to help turn that around."

Though female lake sturgeons lay thousands of eggs at a time, Scribner's team has found that 95 to 98 percent never survive to hatching, and of those that do, 99 percent die in the larval stage. Those survivors must live 15 years before achieving sexual maturity and the ability to reproduce.

"Our primary focus is finding the factors that limit sturgeon survivability in the early stages of their life cycles," Scribner said. "If we can identify the sources of mortality, we can create better management plans to help increase their numbers."

Scribner and his team, in cooperation with the Michigan Department of Natural Resources (DNR), are in the 11th year of pursuing these answers. Though they employ a wide variety of experiments — from studying the organisms that prey on the young sturgeon to the microbial content of the stream and lake water they call home — accurate population estimates over time are absolutely essential to understanding the impact of those threats.

In the spring, when the sturgeon return from the lakes to their ancestral spawning grounds upstream, Scribner's team is in the river daily, using nets to collect the fish and tagging them with an array of tracking devices. Some tags are simply colored markers, enabling the researchers to identify a specific fish on sight. Others are more complex, such as passive inducible transponders (PIT), which are implanted in the fish to detect their exact locations.

The ability to track and monitor Black River sturgeon has taken Scribner's research to a new level of experimentation and analysis. His team has documented the genotype of the nearly 1,200 spawning lake sturgeons, allowing the researchers to identify the parents of newborn sturgeon and make predictions about which genetics are the most beneficial to the species' survival. The technology has also allowed the team to discover which stream environments

sturgeon spawn in, and how various environmental and water quality conditions affect the hatch time and the likelihood that a larval sturgeon will live to adulthood.

"Temperature has a definite effect on their growth rate and survival," Scribner said. "Eggs laid in colder temperatures incubate longer, and the larva that emerges has a larger body size."

Keeping tabs on the lake sturgeon population is crucial to understanding these fish and the threats they face.

"No two years are the same," Scribner said. "You need long-term research when you're studying a fish that can live over 100 years."

*Keeping tabs on the lake sturgeon population is crucial to understanding these fish and the threats they face.*

Scribner's lab has taken their work further, partnering with the MSU Quantitative Fisheries Center (QFC) to understand lake sturgeon populations in Lake Michigan where these same issues apply. Together, Scribner, a QFC associate researcher, and other QFC scientists are using genetic marker data from fish sampled in the lake, where different populations mix, to untangle the dynamics of populations spawning in different streams.

Without the ability to keep accurate records of lake sturgeon population levels, Scribner said this type of research would not be possible, and the future of lake sturgeon would continue to remain troubled.

### Expertise for a challenging task

"There's a famous phrase in fisheries management: counting fish is just like counting trees, only they move and you can't see them," said **Michael Jones**, MSU professor of fisheries and wildlife.

Jones is co-director of the organization formed specifically to help fisheries management agencies tackle that exact



RIGHT: (Left to right) QFC associate director Travis Brenden and co-directors Michael Jones and James Bence lead the center in its mission to assist Great Lakes fishery management agencies with quantitative expertise and training programs. "Our work has caused, I would say, a change of the whole approach people make on these issues," Bence said.

OPPOSITE PAGE: A group of lake sturgeons wait to be fed in Kim Scribner's Black River sturgeon hatchery. The bony ridges along the back and sides are very pronounced during its larval stage, but grow less prominent as the fish matures and eventually vanish in adulthood.



problem. In 2004, MSU joined forces with the MDNR and the Great Lakes Fishery Commission (GLFC) to establish the QFC to provide research and training support to fisheries management agencies around the Great Lakes basin. One of the main objectives was to take advantage of the quantitative and statistical expertise of MSU faculty members. The techniques and technologies pioneered by QFC are very important to researchers such as Scribner and Jones, but they are even more crucial to management agencies, whose scientific needs do not always mesh with traditional academic research programs.

"The agencies' interest in starting our center was motivated by a recognition that, at the time, they lacked the expertise in quantitative fisheries that was becoming increasingly important for good fisheries management in the Great Lakes," Jones said. "Quantitative fisheries science takes a high amount of expertise."

Jones and his colleagues had been developing that expertise, as well as a relationship with the fisheries management agencies of the Great Lakes, for more than a decade through the Partnership for Ecosystem Research and Management (PERM). PERM is a collaborative effort between MSU and the MDNR established in 1993. Its focus has been on traditional

research, however, the need for an entity that could assist with the short-term research and training needs of management agencies became apparent. That's when QFC originated.

"PERM is something that QFC sort of grew out of," said **James Bence**, QFC co-director along with Jones. "When we were first talking about the idea that would become the QFC, the discussion centered around the issue that a lot of times agencies need help on an array of projects that are not really suitable to being regularly sponsored research projects on their own."

Having accurate population estimates is a critical tool in fisheries management because the estimates enable fisheries managers to determine the amount of fish that can be harvested by commercial and recreational fishers and to track the overall health of the ecosystems under their authority. Obtaining them is a challenging, complex task, one that the experts working for the QFC are especially qualified and equipped to perform.

### A numbers game

One way that QFC helps management agencies is through stock assessments, in which all the data an agency has for a particular fishery is integrated to evaluate

the status of an entire fish population. This means combining the numbers of fish with information on age, types of environment and harvest rate. What sounds like simple addition is actually a very complicated mathematical process requiring an in-depth understanding of both fisheries and statistical methods. QFC works with agencies across the Great Lakes to conduct and improve stock assessments.

"We've played a very important role in providing education on stock assessment methods to our agency partners, and we've done important work on species assessments around the basin," Bence said.

QFC scientists have helped management agencies assess populations of walleye in Lake Erie, lake trout in Lake Superior and Chinook salmon across three of the five Great Lakes, among others. By applying highly developed statistical models to the various species, researchers can also develop a description of the underlying characteristics that will affect growth. This provides a window into the future as well as the present. QFC scientists are able to turn this data into forecasting models, which allow their management agency partners to plan for the long-term sustainability of the fisheries in their charge.

"What we do with stock assessments helps the agencies set reasonable harvest



rates,” Bence said. “It helps them determine how best to use their resources, whether they should stock certain species, alter the fraction of a population that can be harvested or even how often they should conduct new stock assessments. How we go about figuring out an issue is often just as important as how we solve it.”

Developing better stock assessment methods is one of the key contributions made by QFC.

“Agencies need to know how many fish there are. That’s a simple question with a very complicated answer,” Jones said. “One of the main thrusts of our work is coming up with clever ways to count fish.”

QFC researchers collaborated to assist the Ontario Ministry of Natural Resources measure changes in the biodiversity of Lake Huron’s fish species using data collected over the past 30 years. Using a technique called dynamic factor analysis, the researchers were able to take data from five locations around the lake, adjust it to ensure that it was comparable and draw conclusions that have helped shape Ontario’s fishery management policies.

“The bottom line was that we found a major decline in the abundance of fish across the community,” said **Brian Maurer**, director of the MSU Center for Statistical Training

and Consulting (CSTAT). “We also found that the proportion of species remained relatively constant, which implied that all species had experienced this decline.”

CSTAT is dedicated to improving the quality of MSU research by providing expertise in various levels of statistical analysis, a mission that makes it a natural partner to the QFC.

“Agencies need to know how many fish there are. That’s a simple question with a very complicated answer. One of the main thrusts of our work is coming up with clever ways to count fish.”

— Michael Jones

“We’re still working on this project, but it’s already a very interesting story that we need to learn more about if we’re going to be wise about how we impact our natural resources,” said Maurer, a professor in the Department of Fisheries and Wildlife and MSU AgBioResearch community ecologist. “Using quantitative fisheries methods has revealed just how huge of an impact we’ve

had on the Great Lakes ecosystem. You have these huge lakes that you’d think we couldn’t possibly have an impact on, but biologically they’ve changed dramatically even in the past three decades.”

The expertise of QFC is important not only for fisheries management agencies but for academic fisheries researchers as well. Better, more refined statistical models are essential for furthering knowledge of fisheries ecosystems.

**Daniel Hayes**, a MSU AgBioResearch fisheries scientist and a professor in the MSU Department of Fisheries and Wildlife, studies dams and dam removals, as well as habitat conditions such as water temperature, plant cover and food resources, and their effects on fish populations. Though his work is focused on the field, it remains quantitative in nature.

“My approach is statistical — that’s the quantitative part,” said Hayes, an associate QFC researcher. “In science, sometimes you find things and nobody uses them, but we help discover how things work through statistical modeling that has real impacts in the world. It’s very applied.”

Hayes and his colleagues have increasingly found that variance among individual fish in a population is an important element in the success of that species, and they



have developed a new statistical model to incorporate that. The individual-based model allows researchers to examine how the differences between individuals in a population affect the whole. For example, though most fish in a population spawn within the same time period, not all fish spawn at exactly the same time. Scribner found through his research that the time a lake sturgeon spawns can determine much about the survivability of its offspring.

“If the water is warm when they spawn, the young develop too fast and hatch in the winter; if it’s cold, they might develop slower and hatch in more favorable conditions,” Hayes said. “We use the individual model to understand this better.”

In Scribner’s lake sturgeon research, only a small percentage of the thousands of eggs live on to become reproducing fish. The individual model used by Hayes looks to answer why that is.

“If you look at young fish, the average fish dies,” Hayes said. “With this model, we’re trying to determine what makes that small percentage of survivors more fit. The average doesn’t always tell us what’s going to happen in the long run, so we need to look more closely.”

## An eye for the future

In addition to pioneering the cutting-edge assessment methods employed in fisheries management and research, QFC is also working to train the next generation of quantitative fisheries scientists. Many graduates of the QFC’s Ph.D. program now work for the federal government, primarily



the National Marine Fisheries Service, tasked with managing on a national level the fisheries of the United States.

“There is a recognized shortage of appropriately trained stock assessment scientists coming into the field,” said **Travis Brenden**, QFC assistant director. “There is going to be a significant wave of retirements, and a lot of students don’t have the training to fill that gap. Our center is one of the few major programs that provide that training.”

One of the driving forces behind management agency support for the center was the need to improve agencies’ capacity for performing activities such as stock assessments, and to that end the QFC provides training for both fisheries students

and agency staff members. Through workshops and online training courses, QFC is helping to expand the capabilities of management agencies, allowing them to improve their use of data. The center has also begun new secondment and visiting scholars programs, in which agency staff and researchers would come work at the center for several months in order to gain a more in-depth knowledge of the methods employed by QFC scientists. The center is also considering expanding its training opportunities with a professional master’s degree program.

“The data they collect is expensive, so it makes sense to keep looking for better ways to use it,” Bence said. “Better training helps them make better management choices,







LEFT: MSU AgBioResearch fisheries scientist Daniel Hayes instructs his class in fish collection on the Red Cedar River on MSU's campus. While much of quantitative fisheries work is done with statistical analysis, acquiring data from fish populations in the field is an essential part of the process.

OPPOSITE PAGE: Brian Maurer, director of CSTAT and MSU AgBioResearch fisheries scientist, provides QFC researchers with statistical support. According to Maurer, studying natural resources, like fisheries, from a quantitative perspective is an important step in learning how best to conserve them.

BOTTOM (from left): Students explore the aquatic ecosystem of the Red Cedar River on MSU's East Lansing campus, learning methods for collecting specimens in the field. Catching and tagging fish in the streams and lakes remains a crucial part of monitoring the populations.

MSU fisheries and wildlife student Sydney Manning learns how to collect and identify crawfish.

Fisheries and wildlife graduate student Kelley Smith wades in the Red Cedar River on the hunt for crawfish.

so fish stocks don't collapse and bigger harvests can be obtained with less risk. The training we provide has helped fisheries management become more rigorous than it was even five years ago."

Fellow fisheries scientist **Christopher Vandergroot** sought out the center to improve his quantitative fisheries skills. He brought back the knowledge he gained at QFC to his work on Lake Erie through the Ohio Department of Natural Resources.

"As a fisheries biologist, the training I received has given me a new perspective to problem-solving and analysis in my current position," Vandergroot said. "QFC's commitment to quantitative and scientific rigor is exemplified in their desire to train not only the next generation of fisheries

professionals, but those currently working in the field, as well."

By bringing the right people together in the right environment, QFC has been able to improve the abilities of both scientists and agency employees to sustainably monitor and manage the fisheries of the Great Lakes.

"QFC plays a critical role in training people, in transferring knowledge and in linking students, scientists and professionals," Hayes said.

### Building a better fishery

QFC scientists and students continue to have a significant impact on the way fisheries are managed. Across the Great Lakes and the United States, they

have changed and refined the ways we understand one of the region's most significant natural resources.

"We're helping to improve the way we manage our natural world," Jones said. "I've always been somebody who's more interested in that than in pushing back the frontiers of knowledge in a more fundamental sense. I'd rather solve messy practical problems than elegant abstract ones, and that's exactly what we do here."

Many partners of the center testify to its positive impacts.

"Ever since its inception, the Quantitative Fisheries Center has provided fisheries managers with the expertise needed to ensure the long-term stability of the Lake





Erie fishery resource,” Vandergroot said. “Because of my experience with QFC, I look forward to interacting with them into the future.”

Equipped to handle a diverse range of challenges, from streams to lakes, food supply to fish mortality and walleye to lake sturgeon, QFC continues to stand as one of the preeminent organizations in its field.

“You never know what request will come in,” Brenden said. “It could be something as simple as developing a program for sorting data or it could be helping to evaluate a water quality management program or a stock assessment model. A lot of what we work on deals with complex species in very large systems, and that can be difficult. It can be challenging, but it’s also very rewarding.” 🍀

RIGHT: Lake sturgeon are hatched and grown at the Black River sturgeon hatchery before being released into three nearby lakes: Black Lake, Mullett Lake and Burt Lake. The current facility was finished in 2009 and plays an important role in both studying lake sturgeon and stocking them in the nearby lakes.

BELOW: The methodologies pioneered by the Quantitative Fisheries Center are crucial in ensuring more species do not suffer the fate of the lake sturgeon, which were decimated by years of pollution and over-fishing. Developing sustainable fisheries models is an important step in helping revitalize their dwindling numbers.







BELOW LEFT: An adult lake sturgeon swimming along the bottom of the Black River. Lake sturgeon are bottom-feeding fish that play an important role in the coupled ecosystem of the Great Lakes and the streams that feed them. *Photo courtesy of Kim Scribner.*





# WEATHERING

A photograph of a winter orchard. The ground is covered in a thick layer of snow. Several bare trees, likely fruit trees, stand in rows, their branches reaching upwards. The sky is a pale, overcast blue.

ABOVE: A harsh winter with extreme cold temperatures can cause severe damage to many agricultural crops, especially fruit. Damage to the Michigan fruit industry during the extreme cold spell of winter 2013-2014 was estimated at more than a half-billion in economic loss.

## Michigan agriculture braces for Mother Nature with help of MSU research

“**D**espite improvements in technology, weather and climate remain among the most important uncontrollable factors in agricultural production systems.”

State climatologist **Jeff Andresen** first heard this statement or something pretty close to it from one of his graduate school professors almost 30 years ago. He has used it ever since and intends to keep it in his repertoire for decades to come.

**BY HOLLY WHETSTONE**  
Editor





# THE CLIMATE

Weather and climate affect all facets of agriculture, and they can do so in dramatically different fashion — what's good for one commodity can be detrimental to another. In Michigan, which boasts the second most diverse agricultural production in the United States, this conundrum translates into lots of opportunities for research. On the flip side, even experienced meteorologists such as Andresen acknowledge that there are certain limitations in the science.

“On one hand, we all know that meteorologists are the brunt of jokes, and some of them are probably justified,” he said. “However, it's also important to note that the science is getting better. For example, weather forecasts are significantly more accurate than they were in past decades. There is also more known

about how weather and climate influence agriculture. That's where Michigan State University (MSU) comes into play. We have a role to provide new science and other information that help reduce weather-related risk for farmers.”

Andresen, a MSU geography professor and Extension specialist, has been helping Michigan farmers prepare for Mother Nature's wrath since coming to work at MSU in 1991. At that time, he was the only MSU faculty member providing meteorology expertise to agricultural producers. Faced with a steep learning curve, Andresen recalls the advice of a colleague that provided the Illinois native more familiar with corn and soybean production one of his most valuable lessons.

“Right off the bat, people from the Michigan fruit and vegetable industries

had lots of questions,” he said. “Initially, I wasn't prepared — the needs were huge. My Extension colleagues were wonderful in providing helpful advice. One suggested that if I really wanted to learn about what fruit growers routinely face, I should plant my own fruit trees, which I did. I quickly started to appreciate how demanding it is to produce these types of crops, given what Mother Nature throws at us.”

Over the years, Andresen has grown apples, cherries, pears, peaches and brambles. He's given blueberries and grapes a try but without much success. The firsthand experience has provided tremendous insight into the challenges confronting Michigan agricultural producers, particularly the fruit industry. And one doesn't have to go very far back on the calendar to find proof of that.



## The nightmare of spring 2012

The spring of 2012 ranks among the most destructive weather periods in Michigan fruit production history, with crop losses valued at more than \$500 million. Unprecedented warm temperatures in March caused overwintering perennials to come out of dormancy more than a month early. The unseasonably early warm-up was followed by damaging freezes in April and May that almost completely devastated Michigan fruit crops. Peach production suffered a 95 percent loss; tart cherry, a 90 percent crop loss; apple production, an 88 percent loss; and grapes, an 85 percent loss.

It was a year that fruit growers wanted to quickly forget and to never relive. It was also the most difficult time of Andresen's career.

"We have about 120 to 140 years of Michigan climate data, depending on location, that is considered reliable. Conditions during March 2012 just blew everything away," he said. "There was a departure from normal temperatures of 13.8 degrees — it's almost unheard of to have a double-digit departure from normal. There were places in the U.P. that went from having over 40 inches of snow to bare ground in one week. These were conditions that had not really been documented or written about before."

With cherry trees in bloom during March, growers knew they were in for trouble. It was only a matter of time before freezing temperatures would return and destroy the buds. And they did with a vengeance, with some locations experiencing 15 to 20 freezes following the unprecedented heat wave, Andresen said.

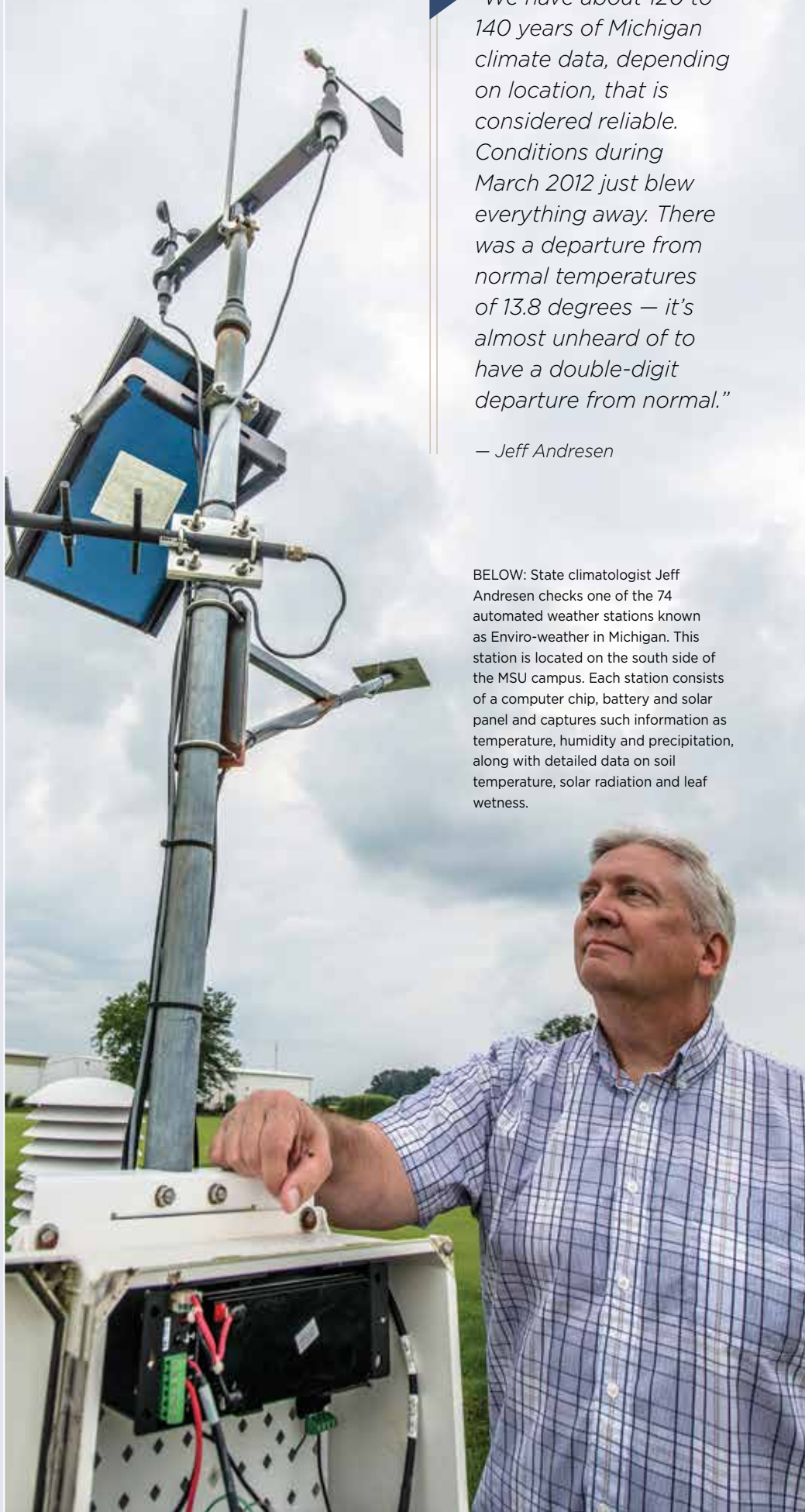
While the Michigan fruit industry was reeling from the devastating losses, MSU AgBioResearch horticulturist **James Flore** had an idea. He knew of a research project conducted in Utah during the 1970s that utilized the application of water to delay tree fruit bloom. Although the research had shown promise, Flore said the technique was not practical at the time because it used large amounts of water, increased incidence of plant disease and decreased fruit set.

Flore, who joined forces with Andresen

*"We have about 120 to 140 years of Michigan climate data, depending on location, that is considered reliable. Conditions during March 2012 just blew everything away. There was a departure from normal temperatures of 13.8 degrees — it's almost unheard of to have a double-digit departure from normal."*

— Jeff Andresen

BELOW: State climatologist Jeff Andresen checks one of the 74 automated weather stations known as Enviro-weather in Michigan. This station is located on the south side of the MSU campus. Each station consists of a computer chip, battery and solar panel and captures such information as temperature, humidity and precipitation, along with detailed data on soil temperature, solar radiation and leaf wetness.







on the new project, thought that incorporating modern-day technological advancements might give more promising and practical results than the initial study. Because plant development is driven by heat accumulation within the bud from exposure to warming temperatures, the researchers knew they would have to cool down the buds. They decided to use water but delivered in a more controlled method than used in the Utah project.

Flore and his team are utilizing three new technologies in the study:

- A solid-state canopy delivery system (SSCD), which finely mists the trees and gives uniform coverage.
- Highly precise orchard weather monitoring and control systems.
- Mist applications based on temperature, humidity and wind, which maximizes the evaporative cooling effect of water while minimizing the amount of water used.

In almost two seasons (2013 and 2014) of testing on Gala, Honeycrisp and Red Delicious apples in four orchards across the Lower Peninsula, Flore and his team have been successful in delaying bloom by five to 11 days on average without any apparent disease or fruit-set issues. They have also been able to substantially decrease water use compared with the 1970s study. Although more work is necessary, Flore remains optimistic.

“Growers using the SSCD to apply pesticides coupled with a weather

monitoring control unit have the potential to avoid flower bud frost damage by delaying bloom by more than a week,” Flore said. “This is important, given that climate change has resulted in earlier blooming of fruit crops, which has increased vulnerability to spring frost — as directly evidenced in spring 2012.”

Andresen said it is advantageous for growers to have procedures that help delay bloom because the spring warm-up is gradually occurring earlier with time, and Great Lakes fruit is particularly vulnerable just following the warm-up. Unfortunately, even though the length of the growing season has increased on average by about 1.5 weeks in the past 30 years, the number and severity of spring freeze events are not decreasing as quickly.

“Overall, this translates to more risk to the grower,” Andresen said. “As a result, for many fruit crops we see more growers installing some form of frost protection technology, such as wind machines. The fans can generate several degrees of warming, but sometimes that’s not enough to prevent cold injury.”

To add insult to injury, the damaging spring in 2012 was followed by the worst drought in Michigan since 1988. Many crops continued to suffer through the summer, but sugar beets ended with a banner crop.

“This one year weatherwise was a train wreck, with the March heat wave followed by a series of freezes and then drought.

ABOVE: MSU AgBioResearch horticulturist James Flore is working with graduate student Ishara Rijal on a research project that utilizes a fine mist of water to keep fruit buds cool and delay bloom during an early spring warmup. Utilizing modern equipment that many fruit growers are already implementing for other purposes, the researchers have been able to delay bloom by up to 11 days.

Almost all of the crops were down in production except sugar beets,” he said. “That was the year for sugar beets, and it just illustrates how some weather patterns can be beneficial to one crop and yet be bad for another.”

## The bitter cold winter 2013-14

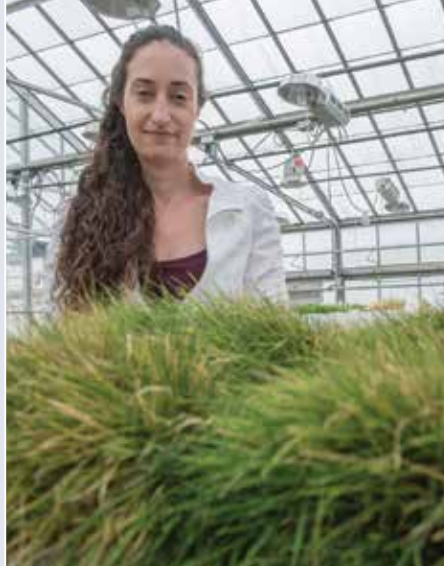
It wasn’t long after spring 2012 when Michigan was hit with more extreme weather. Enter the winter of 2013-14, when a series of bitterly cold air masses rolled down from the Arctic, through Canada and into Michigan. The period between November 2013 and February 2014 was the coldest in Michigan since 1911 and among the five coldest periods on record in the state.

The severe conditions of 2013-14 followed a series of mostly milder than normal winters.

“Unquestionably, the long-term trend in recent decades has been toward milder winters,” Andresen said. “But then you get a winter like last year, and it defies the statistics. It’s literally off the scale, and it just doesn’t make any sense at all. It’s a reminder of the importance of climate

RIGHT: Emily Merewitz, assistant professor in the Department of Plant, Soil and Microbial Sciences, has worked extensively with the turfgrass industry to respond to weather damage. She is leading research that utilizes a growth chamber to simulate severe weather and its impact on winterkill and other turfgrass diseases.

FAR RIGHT: MSU Extension specialist William Shane assesses the peach trees at the Southwest Michigan Research and Extension Center in Benton Harbor. The peach industry was hit hard with near complete devastation from the spring of 2012 and again during the winter of 2013-2014 with an estimated 60 percent loss. Michigan produced 28 million pounds of peaches valued at more than \$12.7 million in 2010.



variability and extremes, which, though few in number, typically account for a majority of weather-related impacts.”

The duration and amount of ice cover on the Great Lakes in winter 2013-14 were the greatest in more than 40-some years, and it was the most extensive and longest accumulation of snow in many portions of Michigan since the late 1970s, Andresen said. It was a trying winter that took a severe toll on wine grapes, peaches and blueberries and seemed to catch everyone by surprise. One source, however, managed to see it coming.

*“I blame the peach tree declines we saw this growing season on an approximate 30-degree temperature drop within a few days from late November to early December 2013 in some Michigan areas.”*

— Bill Shane

“The Farmer’s Almanac was the only source that I’m aware of that forecasted a brutal winter,” Andresen said. “No one, not even the National Weather Service, nor any private organization that I know of saw it coming, so we have to give credit where credit is due.”

Weather forecasting in Michigan is particularly difficult because of the geographic location of the state, Andresen noted.

“Where we are geographically — in the midlatitudes — variability is the hallmark of our climate,” he said. “It has to do with the configuration of the jet stream, the largest and most prominent control in our day-to-day weather. In my professional career, I had never seen anything like the winter of 2013-14 before. It’s extremely unusual for the jet stream to persist in such a pattern over the same area – resulting in the passage of one Arctic-origin air mass after another — for so long.”

For residents of the Midwest and the Northeast, one could probably consider this part of the misfortune of being in the wrong place at the wrong time. In contrast to the frigid conditions in central and eastern sections of North America, most other regions of the Northern Hemisphere — including areas as close as the western United States and Alaska — recorded an abnormally mild winter.

**Mark Longstroth**, a Michigan State University Extension small fruit educator who often writes about weather impacts on agriculture, said that last winter will long be remembered for its extreme cold and high snow accumulation. He explained that most perennial crops grown in Michigan have the ability to withstand subfreezing temperatures, but this past winter tested even the strongest cold-hardy varieties.

“A general rule of thumb is that most of our fruit crops can handle 0 degrees F during the winter as their minimal cold hardiness,” Longstroth said. “With colder temperatures, below freezing, the cold hardiness of the plant cells increases, and our cold-tender plants — such as peaches, blueberries and

wine grapes — can withstand temperatures down to -10 degrees F before we see injury to the fruit buds.”

MSU Extension specialist **William Shane** said the impact of the harsh winter on peaches varied throughout the state; a rough overall estimate is about a 60 percent loss. He said temperatures below -12 degrees F in January and February are tough on peaches, and temperatures below -15 degrees F drastically reduce peach fruit bud survival. Shane said, however, that he suspects that a rapid temperature drop in early December 2013 followed by a warm spell was the culprit in most of the peach damage.

“I blame the peach tree declines we saw this growing season on an approximate 30-degree temperature drop within a few days from late November to early December 2013 in some Michigan areas,” he said. “A lot of older peach and apple trees were pulled out this spring and summer.”

The European wine grapes used to make Merlot, Cabernet Franc and other red wines were also hit hard by the heavy snowfall and subzero temperatures. MSU AgBioResearch horticulturist **Paolo Sabbatini**, also an Extension specialist, urged growers to delay pruning as long as possible during the dormant period to cope with the extensive winter injury.

“The 2013-14 winter was a forceful reminder that cultivar choice and site selection are still the most important tools we have against low winter temperatures, which are typical of our viticulture regions in the Midwest and eastern United States,” he said.





LEFT: MSU horticulturist Paolo Sabbatini works closely with the wine grape industry, including providing guidance in the aftermath of severe weather. As part of his efforts, he assesses field damage and gives advice to growers on such topics as when and how best to prune. In early September, he relayed his findings as a speaker, along with Jeff Andresen, at the “Weathering the Climate: Cultivation and Technology in Grape Production” conference held in Traverse City by the MSU Institute of Agricultural Technology.

The turfgrass industry also reported large amounts of winterkill damage on putting greens and other turf areas in the mid-central to southeastern parts of the state due to the excessive cold and long duration of ice cover. In direct response, MSU AgBioResearch scientist **Emily Merewitz** worked with the industry to obtain a new low-temperature growth chamber. In the chamber, turf researchers evaluate common golf course putting green turfgrass species to see how they may differentially survive ice cover and encasement. They will determine physiological mechanisms of winterkill tolerance, as well as possible effects of commonly used turf chemicals such as plant growth regulators on turf survival of winterkill.

“The growth chamber imitates harsh winter conditions in a controlled setting so that researchers can investigate topics such as ice damage, cold acclimation and de-acclimation, and other issues related to winterkill damage year round,” Merewitz explained.

The winter damage to wheat varied depending on location, with some counties having to replant wheat acres with corn or soybean instead. Despite the tough winter, MSU AgBioResearch wheat breeder **Eric Olson** said the 2014 crop fared better than initially anticipated, with yields just slightly below average. Olson, who is conducting trials through the MSU Wheat Breeding Program, said he is seeing a correlation between grain yield and winter hardiness.

“Lines with exceptional winter hardiness tended to yield much higher,” Olson said. “A positive outcome of the extreme winter

conditions is that lines advanced through the wheat breeding program this year all have exceptional winter hardiness.”

One other silver lining amidst all of the destruction is that the winter’s massive amounts of snow helped to raise lake levels and replenish soil moisture.

## A changing climate

The extreme winter of 2013-14 aside, Andresen said that chronological data shows that Michigan’s climate is becoming warmer and also wetter. The mean annual temperature has risen from 44 degrees F to 46 degrees F since 1980, and annual precipitation has increased about 4.5 inches on average since the late 1930s.

“In Michigan, we have a relatively short growing season compared with other agricultural areas,” he said. “But on paper and at least from our research, these climatic changes have allowed us to become more productive. We have agricultural areas in the state that did not exist two or three decades ago. Some of that is due to improving technology, but the climate has played a role as well.”

Andresen added that drought is occurring less frequently, from about once every 10 to 15 years to once every 20 years.

Providing growers with ways to mitigate the impacts of climate change on agriculture is a research priority for MSU AgBioResearch.

“Weather patterns are changing — we need to respond to the impact on agriculture,” said **Douglas Buhler**, director of MSU

AgBioResearch and associate dean of research for the College of Agriculture and Natural Resources. “We can argue about what’s causing it, but we need to deal with it and learn how to best respond. Our perennial crops are particularly vulnerable to relatively minor changes in weather, so Michigan has a lot at stake in understanding this.”

Climate change is also having potential effects on animal agriculture. Earlier this year, MSU AgBioResearch scientist **Gale Strasburg** was awarded a nearly \$1 million grant from the U.S. Department of Agriculture to study the impact of temperature extremes on turkey development. The project was one of several funded by the USDA to assess the impact of climate change on livestock and poultry.

Strasburg, a professor in the Department of Food Science and Human Nutrition, will assess how turkeys respond to heat and cold stress after being moved from the controlled atmosphere of a hatchery to a farm, and how that may affect the quality of turkey meat, especially the breast, which is the most valuable portion. Having studied genetic and cellular issues in turkeys for over a decade, Strasburg hypothesizes that exposing incubating eggs to a mild temperature increase for two to three hours per day toward the end of their embryonic development will enhance the ability to adapt to thermal stress.

“The turkey industry is really interested in a consistent product, and being able to reduce the effects of extreme temperatures will help maintain or improve that



ABOVE: MSU wheat breeder Eric Olson is focused on developing varieties that are cold hardy and can grow well in Michigan's varied climates. New varieties are started in the greenhouse, and those showing the most promise are transplanted at various MSU research centers throughout Michigan to test their viability.



ABOVE: Extreme weather conditions also impact animal agriculture. MSU food science and human nutrition professor Gale Strasburg is studying the impact of temperature extremes on turkey development. He will assess how turkeys respond to heat and cold stress after being moved from the controlled atmosphere of a hatchery to a farm, and how that may affect the meat quality.

## New book showcases how Midwest climate might change

Michigan State University (MSU) geography professor **Julie Winkler** is the lead editor of a new technical book titled "Climate Change in the Midwest: A synthesis report for the National Climate Assessment."

The report, published by Island Press, also features contributions by several other MSU faculty including **Jeff Andresen** from the department of geography; **Janice Beecher** from the Institute of Public Utilities; and **Sarah Nicholls** from the departments of geography and community sustainability.

Prepared as a more in-depth scholarly exploration of the National Climate Assessment, the book addresses the

potential impacts of climate change on natural systems, human health and several important economic sectors in the Midwest.

"The diverse landscape of the U.S. Midwest and the natural processes, livelihoods and infrastructure associated with them, are vulnerable to climate change," said Winkler. "The challenge will be to design and implement creative and effective adaptation strategies to reduce the region's vulnerability to climate change, while capitalizing on potential co-benefits of mitigation policies."

Coordinated by the Great Lakes Integrated Sciences and Assessments (GLISA) Center and the USDA Agricultural Research Service, the technical report adds more detail to the conclusions of the National Climate Assessment, which listed the following key message for the Midwest:

"Extreme rainfall events and flooding have increased during the last century, and these trends are expected to

continue, causing erosion, declining water quality, and negative impacts on transportation, agriculture, human health and infrastructure."

The peer-reviewed publication is intended for educational research purposes mainly for undergraduate and/or graduate teaching support, as well as to help industry stakeholders make informed decisions on a variety of topics from energy regulation to managing water systems in the Midwest, said Winkler.

Some key findings of the report include:

- Annual mean temperature in the Midwest has warmed since approximately 1900, with annual precipitation generally increasing from the 1930s to present. Regardless of season, intensification of high magnitude precipitation events is anticipated.
- Great Lakes surface water temperatures have increased over



consistency,” he said. “The more efficiently you can produce high quality protein, the more advantageous your position will become. This adaptation strategy, we think, will help our producers do this easily as a component of management practices and without the need to wait for the benefits of breeding more stress-tolerant birds.”

One MSU research endeavor has been gathering valuable long-term weather and climate data for nearly two decades. Enviro-weather is a network of 74 automated weather stations throughout Michigan and six in Door County, Wisconsin (a collaboration with fruit growers there). Started in the late 1990s with funding from Project GREEN (Generating Research and Extension to meet Economic and Environmental Needs), Enviro-weather captures routine information such as temperature, humidity and precipitation, along with detailed data on soil temperature, solar radiation and leaf wetness. Each station consists essentially of a computer chip, a battery and a solar panel and operates on its own to record measurements and

observations of these variables.

Researchers at MSU have developed simple ways for growers to utilize the Enviro-weather data in pest, disease and weed management, as well as irrigation assessments. Andresen said 40 types of products and models are now available through the system, but the majority of requests are for the raw data.

“People most want to see the raw data, and that continues to amaze me. I would have never guessed that,” he said. “Perhaps that means people want to carry out their own types of applications, their own variation. I don’t know.”

Still, it is a reminder of the increasing need for detailed weather information to support agricultural management activities. The number of visits to the site now averages more than 7,000 per day, an increase of over 1,400 percent since 2006, the first year of operation.

Nearing 20 years of data collection at some of its network sites, Enviro-weather will increasingly offer some historical

perspective, also, equipping researchers with the ability to say how common or how unusual a certain type of weather event is.

In the meantime, researchers agree that climate conditions in Michigan are generally improving for agricultural production. Extreme weather events such as spring 2012 and winter 2013-14 are typically challenging and will require research attention. Surrounded now by fellow researchers and Extension specialists looking at various aspects of weather and climate and their impact on agriculture, Andresen is optimistic.

“Compared to when I first started here, MSU now has more faculty and staff members involved in atmospheric science-related research and programs,” he said. “I would definitely say that we’re more effective, and with the larger teams, we are able to address more topics than we have in the past. The science is definitely moving in the right direction, and we’re working hard to find solutions for the agriculture industry.”

the past few decades. Continued warming will impact the timing and extent of thermal stratification, winter ice cover and the availability of dissolved oxygen.

- Adjustments to temperature change would necessitate rapid and perhaps unrealistic movement of plant and animal species if they are to maintain pace with expected shifts in habitat ranges.
- Forest ecosystems may be less likely to provide a consistent supply of some forest products, especially if the dominant species in those ecosystems are at the southern edges of their ranges.
- Changes in the variability, timing and amount of growing season precipitation will have a substantial impact on future crop yields and the number of workable field days.
- Warmer springs and falls will increase the attractiveness of such activities

as camping, golfing and boating while winter sports may be adversely impacted.

- The region has a number of climate-sensitive diseases and health conditions, and, on balance, adverse health ramifications are anticipated to outweigh beneficial health outcomes.

Winkler became involved with the project primarily as a core team member of GLISA, one of 11 National Oceanic and Atmospheric Administration-funded centers that aim to build capacity to manage risks from climate change and the variability in the Great Lakes region.

“The Midwest papers are excellent and give a solid sense of the climate state for our region,” said **Thomas Dietz**, MSU assistant vice president for environmental research. “This collaborative effort was led by GLISA, Michigan State University

and the University of Michigan — all prominent climate entities in the region. It is a very useful collection of papers that should serve many different sectors very well throughout the century.”

This is Winkler’s first experience editing a

book. She grew up on a farm in North Dakota where she became fascinated with weather at a young age. She came to MSU in 1987 after receiving her Ph.D. in geography with a specialization in climatology.

The book is available free of charge at [www.cakex.org/sites/default/files/documents/NCA\\_Midwest\\_Report.pdf](http://www.cakex.org/sites/default/files/documents/NCA_Midwest_Report.pdf)



A row of white Adirondack chairs is positioned on a green grassy hill. In the background, a calm body of water stretches to the horizon under a bright blue sky filled with soft, white clouds. The scene is peaceful and scenic, typical of a Michigan lakeside setting.

**THE**

# Pure Michigan E

**Successful marketing  
campaign has  
widespread appeal**

**BY JANE L. DEPRIEST**

Writer





# ffect

*“The potential problem with having such a phenomenal brand as Pure Michigan is, if a first-time visitor sees one of the ads and decides to come to Michigan, we have to deliver an exceptional experience that meets or exceeds the expectations set by that advertisement.”*

— Sarah Nicholls

“Pure Michigan” serves as the state’s calling card to inform people around the world that the Great Lakes State is full of friendly people, unique experiences and spectacular natural beauty. Delivered by the distinct voice of Michigan native Tim Allen, the ads showcase some of Michigan’s most majestic destinations. Eight years after its launch, the campaign continues to receive accolades and awards and has amassed impressive returns — every dollar spent on the ads has generated \$4.50 of economic impact for the state.

Those within the Michigan travel industry, however, are not resting on the laurels of the Pure Michigan brand. Instead, they are working to build upon its momentum. Michigan State University (MSU) AgBioResearch tourism specialist **Sarah Nicholls** is a prominent leader in this area. At the request of the state’s official travel organization, Nicholls led the development of the 2012-2017 Michigan Tourism Strategic Plan, which plots the course to continue to grow tourism and its contribution to the overall economic development of the state.

“The potential problem with having such a phenomenal brand as Pure Michigan is, if a first-time visitor sees one of the ads and decides to come to Michigan, we have to deliver an exceptional experience that meets or exceeds the expectations set by that advertisement,” she said. “A really good ad raises the bar high.”

Nicholls is facilitating and coordinating the implementation of the strategic plan developed specifically for Travel Michigan, a division of the Michigan Economic Development Corporation (MEDC). Though most states have similar types of plans, Nicholls said very few have a comprehensive, industrywide plan that branches out beyond marketing.

“There are lots of strategic plans sitting on shelves collecting dust — having someone to help ensure that the goals are implemented is very unusual and a fantastic step on the part of the tourism industry and MEDC,” said Nicholls, an associate professor in the MSU departments of Community Sustainability

and Geography.

One of the main objectives in developing the plan was making it comprehensive and inclusive. More than 900 people from various tourism industry sectors across Michigan participated in activities, such as online surveys, visioning sessions and stakeholder meetings, to develop the plan. Now, the implementation process includes diverse groups involved in tourism.

The state’s inaugural tourism plan (2007-2011) was developed by **Donald Holecek**, MSU professor emeritus of the Department of Community Sustainability. It was used as the basis to draft the current plan and vision, and to identify specific goals to move the tourism industry forward.

The plan now lists eight goals, each with a theme and several objectives. Committees meet as many as eight times a year to work on the implementation of each goal.

“What the industry has recognized is that we have one of the best state tourism brands in the country,” Nicholls said. “But the industry also realizes that it has to do more in other areas beyond marketing the brand to deliver an exceptional experience. One of the key points is that this is not just a Travel Michigan plan. No one entity could do all of this. To be successful, we need the whole tourism industry to come together and work really hard, and that’s what is happening.”

The tourism industry is highly fragmented, with representation from lodging, attractions and events, and transportation industries to convention and visitor bureaus, food and beverage providers, and retailers.

“For many visitors to the state, the first stop may be a gas station, so we talk a lot about how to make some businesses more aware that they are part of the tourism industry and that they might represent the first encounter that a visitor to the state has,” Nicholls explained. “One of the goals in the coming years is not only to increase the impact of tourism but also to widen the array of businesses that recognize that they are a part of the industry.”



TOP & ABOVE: Sarah Nicholls, associate professor in the MSU departments of community sustainability and geography, talks locally raised honey with Carl Craft of Bunkerhill Bean Farm at the Dansville Farmer's Market. Nicholls majored in geography as an undergraduate, but an elective course in tourism her senior year made her realize how geography and tourism tied together. She went on to get a master's and Ph.D. in Recreation, Park & Tourism Sciences from Texas A&M University. Nicholls recently developed the 2012-2017 Michigan Tourism Strategic Plan and is now facilitating and coordinating the implementation of the plan.

## Great expectations moving forward

Mike Busley, owner of Grand Traverse Pie Company with his wife, Denise, has served on various committees formed to develop and implement the 2012-2017 plan. He sees the long-term value in developing a plan that goes beyond marketing and serves to meet infrastructure needs.

"Like any organization or business, you need a 'road map' to align goals and efforts," he said. "Although we may not achieve all of the objectives of each goal in the plan, we will achieve a lot of them because we are working in committees on implementation."

Busley is co-chair of the product development implementation committee for the 2012-2017 strategic plan and works on the collaboration, cooperation and partnership committee. Even though he has been actively involved in business in Michigan for almost 20 years, Busley has met many new people connected with aspects of the tourism industry through the venture.

"There are government officials, representatives from the lodging and culinary industries, and many other areas on these committees. They are adding their

own expertise to the goals we are trying to achieve," he said. "It is good business practice to bring people together for common goals."

He believes that serving on the committees — he is also vice chair of the Michigan Travel Commission, a group appointed by the governor to help develop Michigan tourism — has inspired people from various sectors to think about ways within their lines of work to make improvements.

*"Like any organization or business, you need a 'road map' to align goals and efforts"*

— Mike Busley

Like Busley, Jamie Furbush wants to see the strategic plan succeed. President and CEO of the Frankenmuth Convention and Visitors Bureau and recently elected president of the Michigan Association of Convention and Visitors Bureaus, Furbush said her member organizations are benefitting from the Pure Michigan campaign, especially as the strategic plan moves forward.

"The unique thing about this strategic plan





Mike Busley, owner of  
Grand Traverse  
Pie Company

is that it was developed for the industry by the industry,” she said. “There are a lot of things in the plan that the tourism industry needs to address beyond marketing and promotion, such as infrastructure, product development and collaborations.”

Furbush, who was involved in focus groups as the plan was developed, credits the Pure Michigan campaign with helping Frankenmuth evolve its brand and better tell its story.

“Frankenmuth has been a popular destination for many years, but the Pure Michigan campaign has helped us tell our story from a new perspective,” she said. “It has really allowed many different kinds of destinations to shine. It has been a way to showcase the great places in our state and has helped communities realize their potential.”

### Tourism research helps provide resources and boosts impact

The 2012-2017 strategic plan is a key element in raising the bar for Michigan tourism in the coming years, but Nicholls is also focused on other research endeavors. She is collaborating with fellow MSU AgBioResearch scientist **Dan McCole** to work on other types of community sustainability projects that affect the travel industry.

Each spring, they contribute data for the Pure Michigan Governor’s Conference on Tourism. They collect year-in-review data on such factors as hotel occupancy, weather, economics and travel patterns, as well as provide a forecast on the future.

“Many of the factors we look at suggest that Michigan tourism will experience another strong year in 2014,” said McCole, an assistant professor of community sustainability and an Extension specialist.



Jamie Furbush,  
President and CEO  
of the Frankenmuth  
Convention and  
Visitors Bureau

“The stock market, gross domestic product and consumer confidence are all high. Unemployment is down and housing markets continue to improve. People have more and more confidence in the economy and are therefore more comfortable spending money.”

In 2014, McCole and Nicholls predict tourism spending, as measured by hotel and motel tax receipts, will increase 4.5 percent over 2013 levels.

Nationally, leisure travel is growing at a higher rate than business travel, and tourists are increasingly searching for one-of-a-kind experiences instead of chain restaurants and hotels, McCole said.

“More tourists today are interested in sampling regional wines and craft brews, eating at restaurants that serve foods made with locally produced ingredients, and visiting unique cultural and historical attractions,” McCole said. “With every new magazine article that recognizes a Michigan destination and with every Pure Michigan ad, more people realize they can get these kinds of experiences in Michigan.”

Tourism spending was strong in 2013 despite temperatures 9 percent cooler than in 2012. Helping the cause were lower gas prices (down 3 percent from 2012) and positive news coverage, such as Mackinaw City ranking as the top tourist town for families and Grand Rapids being voted Beer City USA for the second consecutive year in 2013.

McCole researches various issues related to natural resource- and agriculture-based tourism. One recent project was a survey of winery tasting-room customers and their behaviors at 15 geographically diverse Michigan wineries.

“Most tasting-room visitors reported that their primary purpose was to participate in experience-based activities such as

## Pure Michigan Fast Facts

- ▶ The advertising campaign launched in 2006 featuring the voice of actor and comedian Tim Allen, a Michigan native.
- ▶ More than 4 million trips to Michigan were made by out-of-state visitors influenced specifically by the campaign in 2013. These trips had a record economic impact of \$1.2 billion, with \$86.5 million in tax revenue generated.
- ▶ Each \$1 spent on the campaign has a cumulative return on investment of \$4.50.
- ▶ Visitor spending in Michigan hit \$18.7 billion in 2013, including a record \$13.8 billion in leisure travel spending. (Source: D. K Shifflet and Associates)
- ▶ It is a brand marketed domestically and internationally by Travel Michigan, the business unit of the Michigan Economic Development Corporation (MEDC).
- ▶ The Travel Michigan budget increased from \$5.7 million in 2005 to \$29 million for 2015.
- ▶ The Pure Michigan national ad campaign, from March through June 2014, had a \$13 million budget, including a first-ever national network television advertisement purchase of \$2 million.
- ▶ In 2014, the campaign received eight Adrian Awards, and Best of Show recognition from the Hospitality Sales and Marketing Association International (HSMAI) for successful hospitality, travel, and tourism-related marketing.
- ▶ In 2009, Forbes magazine ranked Pure Michigan one of the 10 best tourism promotion campaigns ever.

### For more information:

Pure Michigan — [michigan.org](http://michigan.org)

2012-2017

Michigan Tourism Strategic Plan — [michigan.org/lib/files/Industry/Tourism\\_Strategic\\_Plan/Tourism\\_Strategic\\_Plan.pdf](http://michigan.org/lib/files/Industry/Tourism_Strategic_Plan/Tourism_Strategic_Plan.pdf)



*McCole sees many benefits to the Pure Michigan travel campaign, including attracting out-of-state visitors, who tend to stay longer and spend more than Michiganders. A national trend showing an increase in people wanting to do multi-destination vacations bodes well for Michigan.*

BELOW LEFT: Dan McCole, MSU assistant professor of community sustainability and an Extension specialist, believes the explosive growth of wineries and tasting rooms is good for rural communities because not only are the grapes a crop that is growing in demand, but the value added production of turning grapes into wine happens in the local community. In addition, people visiting wine-tasting rooms are also spending money in the community, not just at the winery.

socializing with friends and relaxing,” said McCole, who conducted the survey in collaboration with Holecek. “The experience may be more important in selling wine than the quality of the wine, although I believe the wine has to meet a certain standard of quality.”

McCole points out that friendliness in tasting-room employees is perhaps more important than wine knowledge. The survey also showed that one third of the respondents had visited more than 20 winery tasting rooms in their lifetimes, so engaging with this type of customer may mean repeat business.

“A key takeaway from the study is that people are coming to the winery for a variety of reasons, and, therefore, various presentations and approaches for customer interaction are needed,” McCole noted.

This study was conducted as part of the Northern Grapes Project, an initiative recognizing the emergence of cold-hardy *Vitis riparia*-based wine grape cultivars, which have helped expand small vineyards and winery enterprises in more than 12 states in New England, northern New York and the Upper Midwest, and boosted rural economies in those regions.

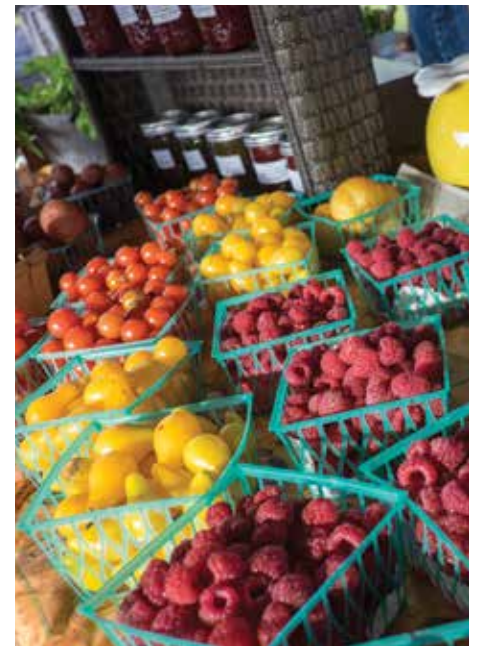
Another project looked at the impact of water levels in the Great Lakes and how that affects tourism, as well as a Sea Grant

project in the Thumb area that is helping communities find ways to attract tourists since the collapse of chinook salmon fishing.

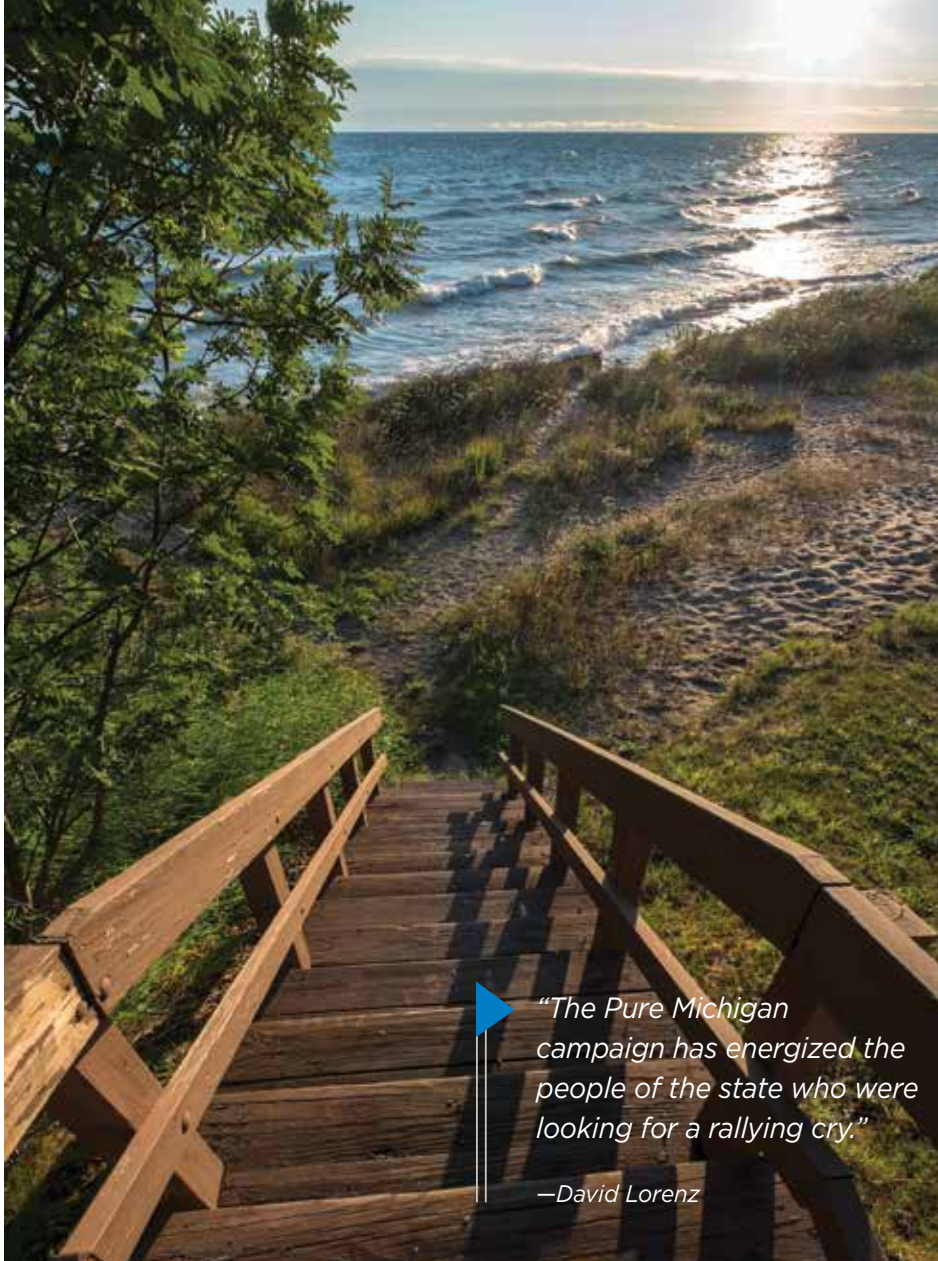
McCole sees many benefits to the Pure Michigan travel campaign, including attracting out-of-state visitors, who tend to stay longer and spend more than Michiganders. A national trend showing an increase in people wanting to do multi-destination vacations also bodes well for Michigan.

“Rather than going to one place, such as a resort, people are interested in exploring a variety of places,” McCole explained. “We have many small communities that people can visit. The wine industry also is perfect for this. Tourists can visit six wineries or shop in two to three communities or pick out a different gourmet restaurant each night of their visit to the state.”

Like McCole, Nicholls also conducts research on many tourism topics, including the implications of climate variability and change for outdoor recreation and tourism. She also has worked on environmental initiatives in the lodging sector. These kinds of projects can inform public policy, as well as provide small business owners with useful findings and associated implications that they are unlikely to be able to generate independently, Nicholls noted.







**David Lorenz,**  
manager of industry  
relations and  
international marketing  
for Travel Michigan

## Increasing the brand impact

As manager of industry relations and international marketing for Travel Michigan, David Lorenz is on the front lines of interacting with the travel industry to attract a continuing stream of tourists to the state. In addition to working with representatives from convention and visitors bureaus, destinations, attractions and communities, Lorenz works extensively with foreign travel agents and organizations, as well as media in key countries such as Germany, Austria, Switzerland, the United Kingdom and Ireland. Travel Michigan will soon open an office in China.

"When travel agents and the media from foreign countries get here, the general reaction is shock at the beauty of the natural environment, because most people internationally think of Michigan as Detroit. There is not a great awareness of our small towns and woods-and-water experiences," Lorenz explained. "Our role is to make them aware of the American experience we have here. This is not New York or Las Vegas or Disney World. This is the real American experience."

Lorenz points out that people are especially impressed with the friendliness of Michiganders.

"In many places around the world, it is not normal to say good morning or hello, but that is part of our culture. That is a real eye opener to international visitors," Lorenz said.

Detroit has traditionally been thought of favorably by most potential international travelers because of its automobile history and music. Detroit's recent bankruptcy, however, temporarily altered the perception



**(Continued on page 28.)**



## 'CHANGING THE FACE OF SCIENCE'

### BEST INVENTIONS:

Electricity, airplane, computer, Internet, Skype and wine.

**Bruno Basso, PhD**



# Bruno Basso

**TITLE:** Associate professor, Department of Geological Sciences and MSU W. K. Kellogg Biological Station

**JOINED MSU FACULTY:** Summer 2012

**HOMETOWN:** Naples, Italy. I lived in Rome before moving to Michigan. I currently live in East Lansing with my wife, Valentina, my daughter, Gloria (10), and my son, Roberto (5).

**MUSES:** My mentor, Joe T. Ritchie [the former Homer Nowlin Chair in the MSU College of Agriculture and Natural Resources and a pioneer in crop modeling], under whom I studied for my Ph.D. He has had the biggest influence on me both scientifically and personally. In addition, Valentina, my wife (I always tell her that I want to be like her); my dad, Francesco, who guided me in the first phase of my life. As for a philosophical character, my muse is Epicurus — like him, I always look for good things and enjoy life.

**FAVORITE FOOD:** Authentic Italian (pasta, risotto, original Neapolitan pizza, fresh mozzarella) and authentic Japanese sushi.

**BEST MUSICAL GROUP:** Radiohead, U2 and Almamegretta. I also like to listen to R&B (Marvin Gaye) and some rap music.

**BOOK I'D RECOMMEND:** *The Elegance of the Hedgehog* by Muriel Barbery; *Zen and the Art of Motorcycle Maintenance* by Robert M. Pirsig.

**COOLEST GADGET:** iPhone and my drone.

**BEST INVENTIONS:** Electricity, airplane, computer, Internet, Skype and wine.

**WORST INVENTION:** Perhaps some social networks, because they may paradoxically pull people apart. The new generation does not seem to be able to talk directly with each other.

**ON MY BUCKET LIST:** More than a bucket list, the thing I love to do the most — besides being with my family and doing research — is swimming in the Mediterranean Sea, especially near Capri, the Aeolian Islands and Taormina.

**PERSON I'D MOST LIKE TO MEET (LIVING OR DEAD):** A dinner with Leonardo da Vinci, truly a unique genius; and Pope Francis, such a great and humble leader.

**BEST TRIP/VACATION:** We love to travel to Australia and see our many friends there.

**ON A SATURDAY AFTERNOON, YOU'LL LIKELY FIND ME:** Swimming at the pool, wandering in a bookstore or playing with my children.

**MAJOR RESEARCH BREAKTHROUGH OF THE NEXT DECADE:** Win the biggest challenge that humanity faces: to be able to produce food for all and still leave behind usable land for the next generation. We are borrowing the land from our grandchildren.

## Scientist works to solve agricultural problems with precision tools

*Michigan State University scientist Bruno Basso is an ecosystem scientist with a special research interest in agriculture.*

*"My main research focuses on improving agriculture sustainability through the integration of biophysics and mathematics, climatology and ecology," said Basso, an associate professor in the MSU Department of Geology and a MSU AgBioResearch scientist. "I am a person who talks to farmers, learns about the issues and uses science to solve the problems."*

*Like other scientists, Basso realizes that the challenges of feeding more people as the world population grows — while not polluting the environment — are daunting.*

*"We have to reduce the environmental impact of fertilizers caused by nitrate leaching and greenhouse gas emissions, and produce more crops per drop of water," he explained.*

*The most important research tools he uses are an unmanned aerial vehicle (UAV), or drone, equipped with advanced sensors, and an ecosystem simulation model combined with GPS technology. It's a process Basso refers to as "precision agriculture."*

*Passionate about wanting to help manage the land for sustainable production, Basso is focused on making new discoveries.*

*"Agriculture is not just farming," he said. "It's being able to produce food for the world but, at the same time, leaving the land for the next generation to use." 🌱*





*“We attempt to add value to everything we produce on the farm, and we sell those products directly to visitors and through outside events.”*

— Don Coe

RIGHT: Don Coe, managing partner of Black Star Farms, believes that farming matters in Michigan and that by creating a durable agricultural economy, there will be lasting opportunities for generations to come.

BELOW: The Inn at Black Star Farms is an agricultural destination in the heart of Leelanau Peninsula wine country. The establishment also offers wine-tasting and dining experiences featuring locally grown produce.



of the city and the state on the international scene, Lorenz observed.

“I can see within the past year that people are starting to better understand what the state is really like, in part because we have brought so many international representatives of travel organizations and the travel media here,” Lorenz said. “That’s why it is important that we are proactive in communication and promotion.”

Lorenz said he believes that one of the strongest impacts that the Pure Michigan campaign has had is to raise the prominence of Michigan in the mind of potential visitors.

“For many years, Michigan was out of the travel promotion business,” Lorenz explained. “We did not promote the state for travel. The Pure Michigan brand has helped to better position Michigan

perceptually, not only for travel but also for potential businesses and for people to live or go to school here. It has changed people’s minds. It’s not that people thought negatively of Michigan — they just didn’t think of us.”

Including well-known Michiganders and Michigan destinations has proven a winning combination. Think Kid Rock singing “Born Free” from Pictured Rocks National Lakeshore or the Chrysler Super Bowl ad with Eminem at the Fox Theater, to name a couple.

“These kinds of projects showed pride in Michigan, and now many other Michigan companies are using the Pure Michigan logo,” Lorenz said. “Companies want to show that they are part of the effort. It has energized the people of the state who were looking for a rallying cry.”

## Michigan’s diverse agricultural crops take center stage

Agriculture has also benefited from the Pure Michigan campaign. Michigan is the second most diverse agricultural state in the nation, and Nicholls said that agri-tourism is of increasing interest to tourists.

“Eating and shopping are the No. 1 and 2 things people do when they travel,” Nicholls said. “Tourists are increasingly interested in knowing where their food is produced and in eating and trying locally produced foods and drinks.”

Furbush agrees.

“Frankenmuth was an agricultural community before it was a tourism destination, so it is part of the culture here,” she said. “Zehnder’s and the restaurants at the Bavarian Inn use local produce.”





The blue Hubbard squash is featured on fall menus at both of the Frankenmuth restaurants. The squash is grown by a local farmer and is popular with restaurant guests. In addition, the Bavarian Inn recently opened a casual dining restaurant called Michigan on Main, featuring Michigan foods and craft beers.

“These examples are common with what you are seeing across the state,” Furbush said. “Many places are featuring local products because it is something that is appreciated and noticed, and visitors are demanding it.”

She also has seen a shift in the mindset of Michiganders wanting Michigan products and seeing more farmers and restaurants working together.

“There is a lot more collaboration, intentional promotion and use of local

products,” she observed.

Perhaps the epitome of agri-tourism success is Black Star Farms, whose story began even before the Pure Michigan brand was developed. In 1997, Don Coe and partners bought a dormant equestrian estate on the Leelanau Peninsula.

“No one lived here, no one was employed here, nothing was grown here,” said Coe from the farm, which is about 15 miles northwest of Traverse City. Today, Black Star Farms provides what Coe calls an “agricultural destination” with a winery and tasting rooms, a distillery, an inn, a farm market and stables on a 160-acre farm with orchards, vineyards and gardens.

“We attempt to add value to everything we produce on the farm, and we sell those products directly to visitors and through outside events,” said Coe, who serves on

the Michigan Commission of Agriculture and Rural Development and was a member of the Michigan Tourism Strategic Plan Advisory Council.

Black Star Farms attracts more than 100,000 visitors annually and employs 55. The farm annually uses more than \$1 million in local products and services, and generates more than \$4 million in economic activity.

“Agricultural tourism is our business, and those 100,000 visitors to our farm last year came from 40 U.S. states and 20 countries,” Coe said. “Every one of those visitors also spent time and money in our state and local economy. We offer the ultimate ‘Pure Michigan’ experience. Most importantly, we are Michiganders, proud of our state and what we do, and that never fails to impress all who visit us.” 📍

# BUILDING A BETTER BLUEBERRY



A Spartan plant breeder  
perfects one of Michigan's finest fruits  
for global consumption

**BY JAMES DAU**

Communications Coordinator



Blueberries enjoy worldwide popularity, thanks to their sweetness and antioxidant-rich nutrition profile. But the bounty of nature alone is not enough to keep pace with the heavy demand for this tasty, healthy fruit. Success depends on the introduction of new cultivars to meet the changing needs of consumers as well as growers. And for more than half a century, Michigan State University (MSU) has been a key player in bringing new blueberry varieties to the table.

Since the early 1900s, blueberries have been commercially grown in Michigan, and today the tiny berries are big business. In 2011, the Michigan blueberry industry spanned 18,000 acres and yielded 72 million pounds of fruit valued at more than \$118 million.

### Breeding Abundance

In the 1960s, MSU horticulturist Stanley Johnston, perhaps best known for developing the Red Haven peach, created both the Northland and Bluehaven blueberry varieties. But few MSU plant breeders have been more successful than MSU AgBioResearch scientist **James Hancock**. A professor of horticulture and recipient of the 2014 MSU Innovation Center Technology Transfer Achievement Award for excellence in applying innovation to create real-world solutions, Hancock developed four of the world's most widely planted northern highbush blueberry varieties: Aurora, Draper, Huron and Liberty (20 million plants of these varieties have been sold), along with several other successful cultivars during the past three decades at MSU.

"Dr. Hancock's legacy of blueberry breeding has increased access to healthy, antioxidant-rich fruit for families around the world," said **Rich Chylla**, executive director of MSU Technologies. "Pairing that with the multimillion dollar impact it's made for growers across Michigan and internationally, the strength of his research program has created a win-win for everyone involved."

Ed Wheeler, a blueberry breeder for MBG Marketing, a Michigan-based marketing cooperative organization for blueberry growers, concurs that Hancock's varieties have benefited the industry from Michigan to the Pacific Northwest and as far away as Chile, parts of Europe and South Korea.

"He has set the bar for blueberry breeding," Wheeler said. "His varieties have done very well here, and they've started to go all over the world and change the types of blueberries that people grow."

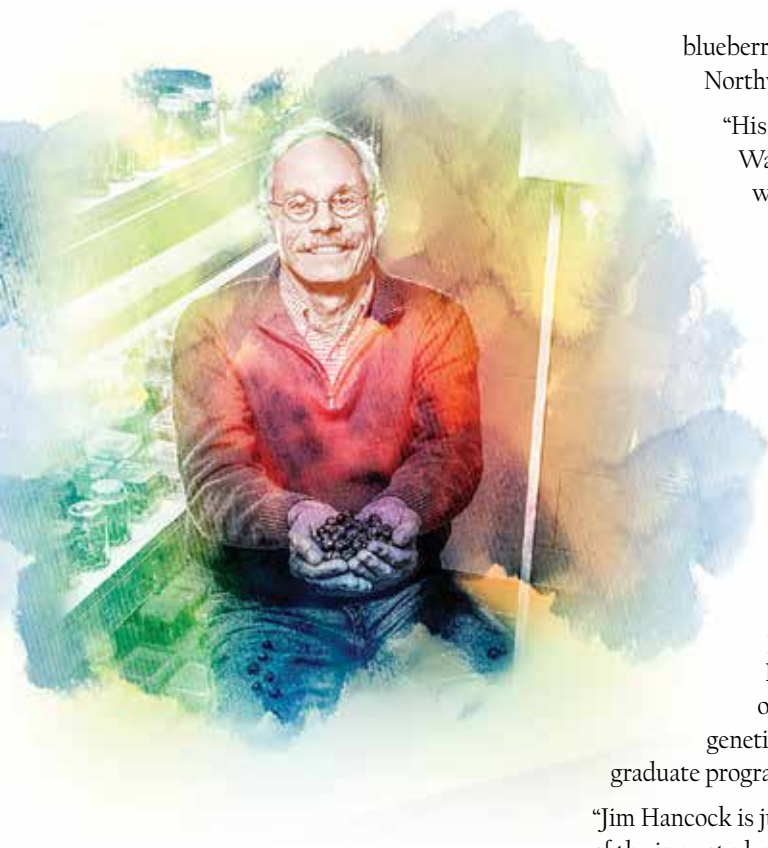
Larry Bodtke, a blueberry grower whose berries grown in Michigan and Oregon are primarily sold under the Naturipe Farms brand, said Hancock's varieties have played a significant role in expanding the

*Hancock's varieties have benefited the industry from Michigan to the Pacific Northwest and as far away as Chile, parts of Europe and South Korea.*



*Illustration on pages 30-33 by Deon Foster, MSU Communications and Brand Strategy.*





blueberry industry in the Pacific Northwest.

“His varieties do very well in Washington and Oregon, where the milder winter climate really helps them grow,” Bodtke said. “A lot of the blueberries planted there are from Dr. Hancock’s varieties.”

The breeding work is revered not only in the blueberry industry but among his academic colleagues as well.

MSU AgBioResearch potato breeder **David**

**Douches** is the director of the MSU plant breeding, genetics and biotechnology graduate program.

“Jim Hancock is just an excellent example of the impact plant breeding can have,” Douches said. “He diligently worked for decades, and what emerged are transformative varieties that created change within the industry and in what we eat.”

## A Growing Evolution

Hancock began working at MSU in 1979. He used his experience in evolutionary genetics to study blueberries and several other small fruits in an effort to identify traits beneficial for commercial production. Ideal blueberry candidates not only have superior taste but are adaptable to environmental stresses and pressure from diseases and insects.

Working closely with U.S. Department of Agriculture blueberry breeder Arlen Draper, in honor of whom Hancock named the Draper variety, Hancock realized the need for new varieties in Michigan. In 1979, Michigan farmers were planting 30- to 60-year-old varieties such as Bluecrop, which thrives in midseason but left sizable gaps at both the beginning and the end of the growing season.

Growers experience their highest profits from early and late harvest, when supplies are lowest. Late-season fruit needs to tolerate the highly fluctuating temperatures

of fall. Hancock’s Aurora and Liberty varieties have a harvest that begins after older late-season varieties such as Bluecrop. Both varieties produce high and consistent yields during the late growing season and tolerate the harsh late-season temperatures.

Both Hancock and Draper had developed extensive germplasm resources — collections of wild and cultivated plants of all shapes, colors and sizes. Combining these sources enabled Hancock to identify the plants with the most desirable characteristics. Hancock’s germplasm bank consists of 121 plants. Eventually he started to crossbreed those plants and trial them at the then newly opened MSU Southwest Michigan Research and Extension Center (SWMREC) in Benton Harbor in the early 1990s.

“If you were to talk to the commodity groups, not just blueberries but almost every crop, new varieties would be one of their highest priorities in current needs,” Douches said.

After 14 years of trials, Hancock emerged with results that exceeded his expectations: six varieties of MSU blueberries that together span the entire growing season.

“As a breeder, I’m most proud of the varieties,” Hancock said. “We released three in 2004, and they’ve all done extremely well, and in the past five years we’ve released three more. I feel good having the whole production season covered, and I think we’ve delivered what Michigan growers needed.”

The timing was also right, Hancock admits. When he started the breeding process, Michigan was by far the leading blueberry state, and there was significant but not huge acreage in the Pacific Northwest and in Europe. The industry in Chile was just emerging and would later become a key player along with Europe and Asia.

“My varieties hit the blueberry wave at the industry’s absolute peak, and that wave is still going,” Hancock said. “Being a successful entrepreneur is not only being really smart and figuring out what’s needed but also being tremendously lucky and hitting that wave when it’s really rolling.”

The first step in the breeding process is to identify which parent plants possess the most desirable characteristics.

# MASTERING THE ART OF THE SCIENCE

Once that is determined, the breeder collects pollen from one parent plant by rolling the open flower between his/her fingers, causing the pollen to fall from the stamens onto a waiting microscope slide. The stigmas of the other parent are then touched to the pollen-laden slide. This causes the plants to produce seeds containing a mix of both parents' genetics. Playing matchmaker between sets of parent plants is one of Hancock's favorite aspects of breeding.

"One of the most fun things about my work is thinking about which parents would give the most beneficial mix of traits, and then putting them together," he said.

Though the hybridization process remains the driver of plant breeding, the tools that breeders use to pursue it are constantly advancing. All MSU plant breeders now integrate some aspect of emerging biotechnologies in their quest to produce improved crop varieties. This can involve anything from simple tissue cultures to more complex procedures, such as genetic engineering to insert or silence certain genes or using gene marker technology to gain a better understanding of the germplasm. For example, tissue cultures are an essential part of the early phase of Hancock's blueberry program, when controlled, sterile laboratory conditions are required for determining how plant traits are developed.

"Our plant breeding faculty take the promise of basic scientific research and translate it into something that can benefit everyone in society, which in this case is new plant varieties," Douches said. "That's our responsibility. We're not asking our basic scientists to become breeders; we're working together with them to link the laboratory with the field."

Many MSU plant breeders focus on crops that are economically important to Michigan. In addition to Hancock's work with blueberries, breeding programs are also producing key new varieties of dry beans, wheat, soybeans, sugar beets, strawberries, tart cherries, cucurbits and

the sugar substitute stevia. Douches has helped produce 15 varieties of potatoes since he began his research at MSU in 1988. Some faculty members are also beginning to explore the emerging field of biofuel crops.

"That's a crosscutting of interesting crops, many of which have more complex genetics than the diploid crops that students are commonly trained in, such as corn," Douches said. "Our students and researchers work on a broad mix of traditional and specialty crops, whereas if you were to go to a school in Indiana or Iowa, you'd be exposed to a more limited set. In that way, we consider ourselves an important school nationwide for training professional breeders that could end up in the public or private sector."

Collaboration is a significant part of what makes the MSU plant breeding program so formidable in specialty crops such as blueberries. While collaboration between breeders and plant pathologists (scientists who study plant diseases caused by fungi, bacteria and other infectious organisms) is the most common, breeding efforts often extend far beyond that.

"We work with a range of scientists, from entomologists and nematologists to faculty in food science, agricultural engineering and genetics," Douches explained. "These interactions have allowed us to broaden our work and adopt new technologies that expand our capabilities."

The hybridized blueberry plants are grown in a greenhouse until they produce seeds. The seeds must be exposed to cool temperatures to encourage a period of dormancy to germinate properly. In nature, this is accomplished under the cover of damp leaves in autumn and snow in winter. To simulate these conditions, Hancock places the seeds in a standard freezer for two months. Then he thaws and sprouts them. When they are large enough, they are planted at the MSU research center in Benton Harbor, where

*Collaboration is a significant part of what makes the MSU plant breeding program so formidable in specialty crops such as blueberries. While collaboration between breeders and plant pathologists (scientists who study plant diseases caused by fungi, bacteria and other infectious organisms) is the most common, breeding efforts often extend far beyond that.*







they are closely observed and evaluated for four years.

“During the summer, I walk up and down the blueberry rows once a week to observe them at different times of the season, and I take notes on every plant,” Hancock said. “We need to identify the ones that are consistently great over the years. They need to be exceptional.”

A blueberry plant must meet a long list of qualifications for Hancock to deem it exceptional, including fruit flavor, color, firmness and size. The plant shape is also important to accommodate harvest techniques, whether mechanical or hand picking. Only about 1 percent of plants make it past the first round of evaluation. Once selected, the exceptional plants are sent to growers worldwide for additional evaluation — typically four to six years — before release to the industry for production.

“All told, from the time we make the first cross between the two plants to releasing a new variety, it can take 10 to 15 years,” Hancock said. “A plant breeder has to be

very patient, but it’s very satisfying to finally reach that point. It’s a rush.”

Hancock also relies on a skilled research team, including lab technician **Peter Callow**, who has been at his side since 1984.

“Pete is steady as a rock,” Hancock said. “He’s been totally dependable, and I’m very thankful for that. Almost all of the work, except field maintenance, is done by just the two of us.”

### A Lasting Legacy

Hancock is planning to retire in 2015, but there is little doubt that his contributions to the blueberry industry will be felt for years to come.

“We’ve infused new blood into the blueberry industry with these new varieties,” Callow said. “His successor will inherit a nice germplasm and be able to hit the ground running.”

Despite valuable and lucrative contributions to the industry over his career, Hancock’s work is perhaps more importantly having an impact on everyday lives.

“Jim Hancock’s values are not in the royalties but in that he developed something successful that’s being used by people around the world,” Douches said. “The royalties are great for the school and for funding the future of blueberry research, but that’s not where his heart is. Breeders don’t get into the business for that — they get into it to create things that will help people.”

This sentiment is echoed by his colleagues.

“He’s been a really great man to work with,” Callow said. “He’s been very supportive of his staff and students, even when he didn’t have to be. He’s very well-liked and respected, and he has a great attitude, even on the most miserable days in the field. I don’t think there’s anything he can’t accomplish. He never accepts defeat, and that’s what has allowed him to create plants that have improved the quality of fruit in Michigan and around the world.”

Douches pointed out that Hancock’s work has not only changed the kinds of blueberries we eat but also when we eat them.

“We’re eating blueberries year-round





LEFT: James Hancock (left) and Peter Callow work with their blueberry germplasm in Hancock's MSU lab. As a collection of genetic resources, germplasms are essential tools for plant breeders as they endeavor to find useful traits for new varieties. While they are assisted by a crew of workers in the field, Hancock and Callow make all the breeding crosses and grow the seedling plants themselves.

OPPOSITE PAGE: Peter Callow, research assistant to James Hancock since 1984, examines blueberry plants in a greenhouse on MSU's campus. Callow has helped Hancock develop every one of his blueberry varieties, effectively changing the face of the global blueberry industry.

BELOW: In 2003, U.S. Secretary of Agriculture Ann M. Veneman declared July National Blueberry Month, in recognition of the native fruit's economic and dietary importance.



*A blueberry plant must meet a long list of qualifications for Hancock to deem it exceptional, including fruit flavor, color, firmness and size. The plant shape is also important to accommodate harvest techniques, whether mechanical or hand picking. Only about 1 percent of plants make it past the first round of evaluation.*





now, whereas 10 years ago they were a seasonal crop that didn't taste very good in the off-season," he said. "His varieties have fundamentally changed the global blueberry market, turning it into something much bigger than it ever could be before."

Hancock's legacy will continue to flourish in the lives and careers of his students.

"Jim trained a number of graduate students over the years, and that's an important part of his legacy," Douches said. "About half of our grad students are international, so his knowledge is spreading not just around the country but around the world, and that's a beautiful aspect of our program and the university as a whole."

And retirement will not likely detract from Hancock's love of blueberries.

"It's hard for a breeder to retire — you're always thinking about the possibilities of

new plant crosses," Hancock said. "It's a passion." 🍷

*"We're eating blueberries year-round now, whereas 10 years ago they were a seasonal crop that didn't taste very good in the off-season. His varieties have fundamentally changed the global blueberry market, turning it into something much bigger than it ever could be before."*

— David Douches

ABOVE: Michigan has over 18,000 acres of farmland devoted to blueberry growing, yielding an average of 5,000 pounds of blueberries per acre, according to the Michigan Ag Council. In 2013, 47 million pounds of Michigan blueberries were produced for fresh use, with another 67 million pounds for processing.

OPPOSITE TOP: James Hancock began breeding blueberries at MSU's Southwest Michigan Research and Extension Center in the early 1990s, where his fieldwork still continues. Each year, Hancock begins a new variety trial in his efforts to continually refine Michigan blueberries and produce the best plant for both growers and consumers.

OPPOSITE BOTTOM: Ed Wheeler, blueberry breeder for MBG Marketing, says Hancock has set the bar for blueberry breeding. Hancock's varieties are grown around the world, benefiting the blueberry industry on four continents with better fruit quality than those that came before.





## Blueberry varieties developed by James Hancock:

- ▶ **Aurora** (2004) – latest ripening season of any northern highbush
- ▶ **Liberty** (2004) – late-season, high yields, exceptional flavor
- ▶ **Draper** (2004) – midseason, high yields, unusual fruit crispness, exceptional storage life
- ▶ **Huron** (2012) – early-season, excellent taste
- ▶ **Osorno** (2014) – late midseason, exceptional fruit quality, unusual heat tolerance
- ▶ **Calypso** (2014) – late midseason, high yields, excellent flavor

## Blueberry fast facts:

- ▶ For the past 70 years, Michigan has been the No. 1 producer of highbush blueberries in the nation.
- ▶ There are approximately 21 wild blueberry species and over 40 cultivated varieties.
- ▶ With 18,000 acres, Michigan leads the nation in highbush production.
- ▶ Blueberries are grown, harvested and processed by 600 family farms in the state.
- ▶ Blueberry harvests annually contribute more than \$118.5 million to Michigan's economy.
- ▶ Allegan, Berrien, Muskegon, Ottawa and Van Buren counties are primary growing regions.
- ▶ Draper and Liberty are the most widely planted northern highbush blueberry varieties in the world.
- ▶ Blueberries are one of the only fruits native to North America, but they are found on almost every continent.
- ▶ One of few naturally blue foods, blueberries don't start out that way. They first appear white, turn red and finally turn blue, making them the "all-American" berry.
- ▶ July is National Blueberry Month.
- ▶ The annual North American blueberry harvest, spread in a single layer, could cover a four-lane highway from Chicago to New York.





# Nature calls:



**BY NATASHA BERRYMAN**

Writer



# Pursuing research in the perfect setting

**B**oasting more than 18 million forest acres, 49,000 miles of rivers, some 35,000 inland lakes, countless wetlands, marshes and swamps, 200,000 acres of sand dunes and the world's largest surface freshwater system — the Great Lakes — Michigan has an impressive list of natural resources. Add in the wide variety of microclimates and an abundance of wildlife species — from tree frogs to American black bears — and the state quickly becomes an ideal living laboratory for scientists and the students following in their footsteps.

Michigan State University (MSU), the nation's pioneer land-grant university, provides students with unique hands-on opportunities to explore nature's bounty. And many of these next-generation scientists are unearthing ways to protect and preserve Michigan's natural resources.

## Assessing habitats in young forests

For more than 160 years, northern Michigan's timber industry has supplied raw materials used to create many products, including homes, furniture, paper and renewable fuel. The harvesting, however, has been associated with declines of various wildlife species because of changes in the forest habitats. In response, the Michigan Department of Natural Resources (DNR) has issued several operational guidelines for timber harvests on state-owned land. These DNR guidelines encourage harvesters to leave 3 to 10 percent of the land untouched for wildlife habitat.

While working on doctoral degrees from the MSU Department of Fisheries and Wildlife, and the Ecology, Evolutionary Biology and Behavior Program in 2012 under the guidance of MSU assistant

professor **Gary Roloff, Clint Otto** wanted to examine the impact of habitat retention on songbirds and salamanders in harvested forest stands. Otto said he chose those species because they are akin to "canaries in a coal mine," meaning that their presence — or absence — is a good indicator of the health of the environment.

"Wildlife biologists have long recognized that, even in clearcut areas, you can leave green structures behind to encourage use by various wildlife species," Otto said. "I wanted to determine whether areas with more structural retention were used more often by forest-dwelling wildlife than areas with less structural retention. I also investigated how early-successional songbirds respond to structural retention, and conducted an in-depth investigation of whether structural retention reduced red-backed salamander mortality in recently harvested forest stands."

Otto determined that the amount of habitat retention did not play a significant role in attracting forest-dwelling songbirds to recently harvested forest stands. Instead, many young songbirds selected habitat sites based on the age of the trees rather than the availability of green structure.

"We initially predicted that forest

songbirds would utilize clearcut patches with higher levels of structural retention than patches with lower levels," he said. "However, after conducting the research, we found no difference in the use of stands that had a lot of structural retention versus those with little or no retention."

He noted one exception to this finding: the red-eyed vireo, a mature forest bird, utilized forest stands with more structural retention.

"We also predicted that early-successional songbirds, such as chestnut-sided warblers, would show decreased use of clearcut patches with lots of structural retention," he added. "However, our field data did not support this hypothesis. We observed consistent use of forest patches within young stands with varied levels of structural retention by all of the early-successional songbird species."

Overall, Otto concluded that structural retention didn't promote use of clearcut areas by mature forest birds. The retention also didn't affect the early-successional songbird species, which continued to use the space despite a natural tendency toward other types of habitat conditions.

To test the effect on salamanders, the team set up enclosures with varying





amounts of structural retention in recently harvested forest patches and placed 10 marked salamanders into each. At the time, it was not known whether structural retention provided adequate microhabitat and reduced or prevented mortality of salamanders, which rely on protective groundcover to prevent dehydration in the summer heat.

“We found exactly what we expected: in spots where there was a lot of retention, more salamanders lived than in those sites where all the harvest materials were removed from the forest stand,” he said. “However, when we scaled-up our study and looked at the total distribution of salamanders within clear-cut areas, we found a nearly equal distribution of salamanders between sites regardless of how much structural retention was left.”

Otto and his team wondered why they had observed such a strong, positive benefit of structural retention at the small scale but not on the large one.

“I think this discrepancy highlights the importance of using multiple approaches to tackling any scientific problem,” he said. “This ensures we get results that tell us the complete story and ultimately lead us to the strongest conclusions.”

His research has helped inform the DNR.

“They called on us to provide unbiased information so they could adapt their management,” he said. “This partnership between scientists and natural resource managers represents a great team effort.

The Michigan DNR operates with a limited budget, but they chose to invest in this research because they have a genuine interest in knowing if their management practices are effective.”

*Otto graduated from MSU in 2012 and is currently a research ecologist for the U.S. Geological Survey at the Northern Prairie Wildlife Research Center in Jamestown, North Dakota.*

### Preserving trout resources in Michigan

MSU Department of Fisheries and Wildlife master’s student **Elle Gulotty** also had an interest in studying the effects of Michigan’s historical timber and logging industry. She has been examining the Au Sable River and the impact of tree removal along the banks to move the logs downstream on the river’s trout population.

The 138-mile river flows from Grayling to Oscoda and serves as an important energy source (it houses six hydroelectric dams) as well as a place for outdoor recreational opportunities — fly-fishing is one of the most popular. Beginning in the 1930s with the Civilian Conservation Corps, local anglers, conservation groups and state agencies have made a long-term commitment to improving river habit by placing various structures in the north branch of the river. Their efforts continue today.

“Some of these structures were meant to provide adult trout cover (from avian

predators, for example) en route to spawning beds,” she explained. “Others were placed in hopes of influencing stream dynamics in a manner favorable for the trout, such as causing scouring and increased non-uniformity of depth and substrate. Some of these structures seemed to work well, but others didn’t. But across them all, there was a need for a formal evaluation of their success and how these structures affect the flow of the stream.”

Gulotty is working under the guidance of MSU AgBioResearch professor **Daniel Hayes** to document the varying densities and types of structures in the river’s north branch. It is part of a field of study known as fluvial geomorphology, which includes the examination of rivers in their natural states and in response to human-induced changes in the watershed. Her findings will help natural resources managers fine-tune the placement of these structures and provide data on the efficacy of their use.

The team divides the river into cross-sections based on the location of habitat structures. At those sites, they map the habitat, the structures and the structures’ effect on water depth, discharge and velocity.

“We found that some of these structures mostly provide an area where fish can hide. Others provide a few feet of cover and then a much larger swath of silt falling because this stream is pretty low power,” she explained. “Those metrics are important when you’re trying to determine what



is needed to recruit fish to an area of the river and what type of structures are best suited for the specific conditions of certain sections of the river.”

Gulotty then assessed the general fish population, including the trout.

“We can put all of these findings together to tell us what’s going on in the river, how the structure influences the fluvial geomorphology, what fish species are present and what trout species are present,” she said. “Taking these measurements gives us the whole picture.”

*“There’s very strong community support for the [Au Sable River]. People in the area love this river and are active stewards of this resource...”*

— Elle Gulotty

Working closely with local conservation groups — such as the Anglers of the Au Sable and the Kalamazoo Valley Chapter of Trout Unlimited — and government agencies, Gulotty has been afforded a unique opportunity to learn about the importance of collaboration.

“Contrary to some other systems I’ve worked in, there’s very strong community support for the river,” she said. “People in the area love this river and are active stewards of this resource. They’re

passionate about it, they’re knowledgeable, and we’ve been able to partner with them and seek their input. From locals and conservation groups to folks from the DNR and the Michigan Department of Environmental Quality — all of them have helped us better understand this system.”

And Gulotty feels especially fortunate to have worked with Hayes.

“There is cooperation between really passionate and bright people I wouldn’t have had access to if it weren’t for meeting and working with Dr. Hayes,” she said. “There is an onus on me to try to live up to the standard he sets. If I could continue in the direction his past students have gone, I would be very satisfied with my contribution to the resource.”

### Preventing vehicle-deer collisions across the Midwest

The Michigan State Police annually record nearly 50,000 vehicle-deer collisions in the state. Despite the fact that deer are most active in the spring and fall, crashes are a year-round issue that can cause motorists serious injury and sometimes death, not to mention costing lots of money in automobile repairs. In 2012, roughly \$130 million was spent fixing damage from collisions with deer. On the wildlife side, nearly all animals involved in wildlife-vehicle collisions (WVCs) eventually die.

**Nathan Snow**, a 2014 doctoral graduate from the MSU Department of Fisheries and

OPPOSITE PAGE: The red-eyed vireo and red-backed salamander were two of the species assessed in Clint Otto’s study that measured wildlife responses to timber management practices. He studied under the guidance of MSU professor Gary Roloff.

ABOVE: Elle Gulotty, who is earning a master’s degree from the MSU Department of Fisheries and Wildlife under the guidance of MSU AgBioResearch professor Daniel Hayes, explained that the community surrounding the Au Sable River is dedicated to conserving the river’s ecological and intrinsic value.

Wildlife and the Ecology, Evolutionary Biology and Behavior Program, was interested in knowing more about human-wildlife conflicts. Under the guidance of MSU professor **William Porter**, he dedicated his doctoral studies to understanding where WVCs occur and the environmental factors that increase their likelihood. He used data on three species of wildlife — island foxes in California, white-tailed deer in the Midwest and moose in Maine — to explore the issue.

“Today’s technology has created new ways of collecting data on these collisions,” Snow said. “For instance, there are smart phone apps people can use to record collisions or to report dead deer on the road. This has given us access to a lot of data, but I was still left wondering, ‘Are they good enough to use in scientific research — to actually understand what’s influencing where these collisions occur?’ Once we understand why they are occurring in certain locations, then we can make some decisions to mitigate them.”

Snow explained that about 50 percent of



BELOW: Daniel Hayes and a team of graduate students lead a discussion during a demonstration on the Red Cedar River as part of Hayes' fundamentals of fishing and wildlife lab.



deer-vehicle collisions are not reported and, therefore, not captured in data.

"Lots of people hit deer, but sometimes the animal runs away, or people pick it up, put it in the car and take it home, never reporting it to the police," he said. "I was concerned that this might skew the data we're using to study the larger problem."

Snow found that data on only about 30 percent of deer- and moose-vehicle collisions were needed to make reliable inferences about the environmental variables influencing the location of the crashes. He also examined whether it was possible to define spots where collisions are more likely to occur.

"When we find a hotspot, we put out road signs that warn drivers to be careful, or we take some other sort of mitigation action," he said. "But one of the things I think we're lacking is a process to define and identify

hotspots. When you look at the research, you'll find that people define them in different ways."

Historically, hotspots are defined by distance, which is subjective and sometimes arbitrary.

"We know that the landscape influences where WVCs occur, so I tried to use it to draw the boundaries around these areas," Snow said. He found that when the landscape is used to define hotspots, they are much larger than previously thought.

Snow explained that every state in the U.S. deals with some sort of WVC, but the Midwest has some of the highest rates of these collisions. "Because it's such a broad problem, I wanted to look at the broad-scale patterns of these collisions; no one has really explored that angle," he said. "There's been a lot of work to look at each specific collision location to try to identify

why collisions occur there, but I wanted to explore why, for instance, southwestern Michigan has so many more collisions than northern Illinois, which has a similar landscape."

His research analyzed county-level data from five Midwestern states across 12 years and revealed a phenomenon he calls "the suburb effect:" communities with suburban landscapes experience more collisions and more severe ones than other types of landscapes. Snow explained that deer live in close proximity to humans in suburban communities. Often, these communities infringe upon deer habitat, hunters don't usually hunt in these areas, and traffic tends to be heavy in and surrounding these communities.

"In rural areas, there may be a lot of deer, but there just isn't a lot of traffic, so there will be fewer collisions," he concluded.

“But in suburban areas, you have the perfect storm of good habitat, a lot of deer and a lot of traffic. This phenomenon was consistent across all 12 years I analyzed. Knowing that helps me draw the conclusion that it may be worth investing in extensive, long-lasting mitigation efforts, such as building underpasses for wildlife to safely cross roads.”

*(Snow’s) research analyzed county-level data from five Midwestern states across 12 years and revealed a phenomenon he calls “the suburb effect.” This means that communities with suburban landscapes experience more collisions and more severe ones than other types of landscapes.*

Snow said he enjoyed his educational experience at MSU.

“The fisheries and wildlife department created a great environment for its students. Everyone was friendly and quick to help; they’re very concerned about your best interest. They want you to leave highly competitive and create lots of opportunities for you to do that. I definitely think my choice to attend MSU was worthwhile.”

*In the summer of 2014, Snow accepted a position in Colorado as a postdoctoral researcher working on feral swine; it is a joint position between Texas A&M University and the U.S. Department of Agriculture.*

## Exploring the culture of venison sharing

**Amber Goguen** has always been interested in studying nature, but it wasn’t until she had the opportunity to travel and conduct fieldwork that she really began to see just how intertwined humans are with the environment. Through these experiences, Goguen — a dual master’s- and doctoral-degree student in the MSU Department of

Fisheries and Wildlife under the guidance of MSU AgBioResearch professor **Shawn Riley** — became deeply interested in exploring the intersection of wildlife, people and food.

“When it came time to find a mentor for graduate school, I contacted dozens of professors,” she explained. “Dr. Riley said he was looking for a student to ‘research the role of game meat consumption in attitudes toward hunting and environmental conservation.’ I couldn’t have asked for a better mentor or for a project more in line with my interests.”

Riley has done research in Sweden on the consumption of wild-harvested meat to examine how this influences non-hunter attitudes toward hunting.

“Currently, Dr. Riley and I are conducting preliminary research on the extent of wild harvested meat consumption and sharing in Michigan for a larger project seeking to detect and quantify the effects of wild harvested meat consumption and sharing on society,” Goguen said. “We will be taking some of the methodologies developed in Michigan to Sweden to continue our research with colleagues there. Ultimately, we hope to compare the findings from both countries to determine the effect of governance structure and social norms on wild-harvested meat movement through society.”

Michigan is an archetypical state for white-tailed deer hunting in the Midwest. Deer are abundant and widely distributed throughout the state. White-tailed deer are one of the largest game species in the state, and 92 percent of Michigan hunters purchase deer licenses. In 2013, more than 660,000 Michigan hunters harvested an estimated 385,000 deer. Goguen estimates that the 2013 deer harvest produced 15 million to 25 million pounds of venison — that equates to six to 10 meals per person, if the meat was distributed evenly to the entire population of the state.

Hunting is an important cultural tradition in Michigan and contributes funding to statewide wildlife conservation efforts. Maintaining the relevancy of hunting in



ABOVE: Nathan Snow, a 2014 doctoral graduate from the MSU Department of Fisheries and Wildlife, and the Ecology, Evolutionary Biology and Behavior Program, explained that the time he spent at MSU gave him a skillset he can leverage to explore a variety of research questions in the future. He studied under the guidance of MSU professor William Porter.

*(Continued on page 50.)*



### CUCUMBER FAST FACTS

- Michigan is the No. 1 producer of pickling cucumbers in the country, with the average crop worth \$45 million to Michigan farmers.
- The value of Michigan fresh market cucumbers is roughly \$18 million.
- Cucumbers are cool and moist because of their high water content — they're almost 96 percent water.
- One-half cup of sliced cucumbers is just 8 calories. They are also low in fat and sodium and are a good source of vitamins C and K, and potassium.
- The term “cool as a cucumber” is derived from the cucumber’s ability to cool the temperature of the blood. When applied topically, cucumbers can cool the blood and ease swelling, which is why they are popular facial regimens.
- In 1961, MSU researchers Bill Stout, Max DeLong and Stan Ries developed the once-over cucumber harvester, which increased the efficiency of harvesting pickling cucumbers and changed the way cucumbers were grown around the world.



# COOL AS A CUCUMBER

### Creamy Michigan Cucumbers

1/2 cup sour cream or plain yogurt  
1 tablespoon vinegar or lemon juice  
2 tablespoons granulated sugar  
1/4 teaspoon dried dill (optional)  
1 teaspoon salt  
Dash of black pepper  
1 large, fresh Michigan cucumber, halved lengthwise and thinly sliced (about 3 cups)  
1 small onion, thinly sliced and separated into rings

In a medium bowl, stir together sour cream, vinegar, sugar and dill. Season with salt and pepper. Add cucumber and onion slices. Toss to coat. Cover and chill for 2 to 48 hours, stirring often. Stir before serving.

Makes 6 servings.

*Recipe courtesy of Michigan Vegetable Council:  
<http://www.michiganvegetablecouncil.org/>*

## Hunting down pathogens and fighting back

Michigan's multimillion dollar cucumber crop has two enemies: *Phytophthora capsici* and downy mildew. These create significant problems with growing cucumbers and all vegetables in the cucurbit class, such as watermelon, cantaloupe, gourds, squash and zucchini.

"These two problems — *Phytophthora* and downy mildew — truly threaten the viability of growing cucumbers in Michigan. They could take out the industry," said MSU AgBioResearch scientist **Mary Hausbeck**, who has worked effectively to help growers understand and control these two diseases for more than 20 years.

One of her research team's first discoveries was that *Phytophthora* was resistant to Ridomil, a key fungicide that used to be effective at controlling the fungus. To help cucumber growers with this problem, Hausbeck, a professor of plant, soil and microbial sciences, and her research team developed best growing practices, including subsoiling, raised beds, drip irrigation and early destruction of infected crops.

Downy mildew entered the Michigan vegetable scene in 2005. It is a water mold pathogen that affects cucurbits. Before that time, cucumbers had strong genetic resistance to downy mildew, which has since returned every year to trouble growers. 2014 proved to be a very difficult year for growing cucumbers and other cucurbits because the wet, cool weather promoted downy mildew.

One aid for growers with downy mildew is spore trapping, which Hausbeck's research group has done for many years to alert

growers when the pathogen is present in the state. Growers use this early warning system to time their crop protection programs, saving money and helping to prevent fungicide resistance.

"This is a huge effort for our lab," Hausbeck said. "But it has been accurate each year in getting the warning out to growers."

MSU researchers are also looking for long-term solutions to *Phytophthora* and downy mildew. MSU AgBioResearch scientist **Rebecca Grumet** is screening for sources of *Phytophthora* resistance that could be useful for breeding. In an initial screening round, Grumet discovered an age-related resistance.

"The young fruit are very susceptible, but as the fruit develops it becomes resistant to *Phytophthora*," explained Grumet, a professor of horticulture. That fact allowed growers to be better informed about when to use sprays to protect the fruit.

Since then, Grumet's research team has identified other germplasm with distinct patterns and changes in gene expression as fruit goes through stages of early development. Her research group has also identified three cucumber accessions (unique identifiers) that may serve as sources of resistance in young fruit.

"These are important steps forward in helping to eventually pinpoint individual genes that may lead to conventional breeding for resistance or other resistance mechanisms," Grumet said.

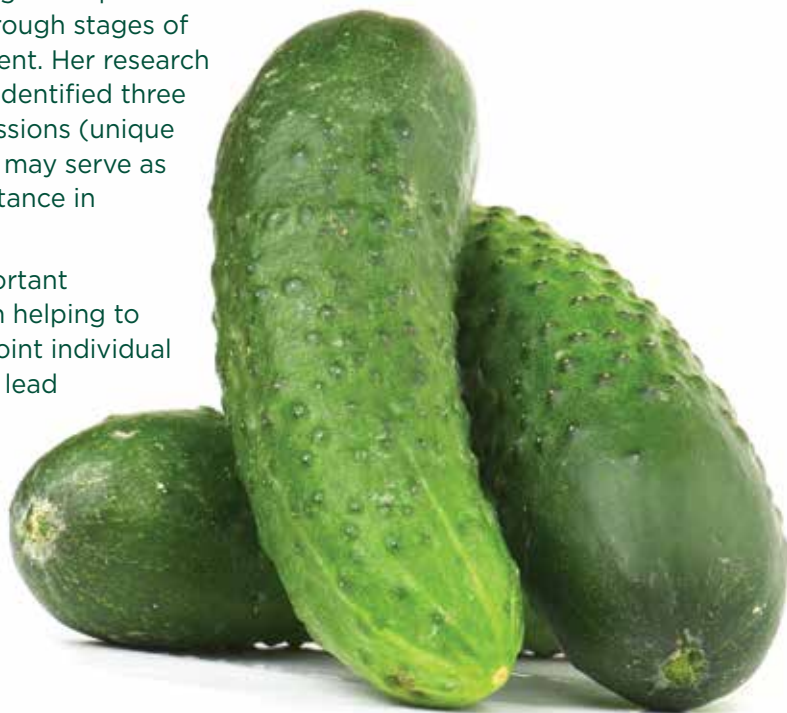


Mary Hausbeck, professor in the MSU Department of Plant, Soil and Microbial Sciences



Rebecca Grumet, professor in the MSU Department of Horticulture

*One aid for growers with downy mildew is spore trapping, which Hausbeck's research group has done for many years to alert growers when the pathogen is present in the state.*





## > Director appointed to new national agriculture research board

**Douglas Buhler**, director of Michigan State University (MSU) AgBioResearch and College of Agriculture and Natural Resources Senior Associate Dean for Research, has been named to a 15-member national board of directors of the new Foundation for Food and Agriculture Research (FFAR).



**Douglas Buhler**

The foundation leverages public and private resources to increase the scientific and technological research, innovation and partnerships critical to boosting America's agricultural economy.

The Foundation, created by the 2014 Farm Bill, is an independent nonprofit corporation that will leverage private and public funds to advance agricultural research. The FFAR Board of Directors will establish policies, governance structures and priorities. FFAR research will benefit such areas as:

- Plant and animal health, production and products
- Food safety, nutrition and health
- Renewable energy, natural resources and the environment
- Agricultural and food security
- Agriculture systems and technology
- Agricultural economics and rural communities

FFAR also fosters collaboration amongst agricultural researchers to meet emerging research needs

through grants, contracts, cooperative agreements and memoranda of understanding.

"Agricultural research today is a critical component in American — and global — health, security and prosperity," said Michigan State University President Lou Anna K. Simon. "Senator Stabenow deserves great credit for her leadership in establishing the foundation in the Farm Bill, and the USDA's selection of Dr. Buhler puts a highly knowledgeable and experienced scientist/administrator on the foundation board."

## > Smith named new acting associate director

**George Smith**, Michigan State University (MSU) animal science professor and co-director of the MSU Reproductive and Developmental Sciences Program, was named acting associate director of MSU AgBioResearch effective July 1.

Smith replaced John Baker, who is now serving as dean of the MSU College of Veterinary Medicine. In the new part-time role, Smith provides leadership to the MSU AgBioResearch animal science research portfolio, oversight of the Office of Research Support and operation of the organization along with Director Douglas Buhler.



**George Smith**

Smith will continue his research, which focuses on the fundamental mechanisms that control ovarian function and contribute to egg (oocyte) quality in cattle as a biological model for reproduction in economically

important agricultural species, as well as in human medicine. His research has been continuously funded by the U.S. Department of Agriculture (USDA) or the National Institutes of Health (NIH) since 1998.

Smith has been the lead or co-lead on grants totaling over \$9 million and published 101 peer-reviewed research articles and 16 invited reviews, and his research group has also filed two patents. He has also served on grant review panels for USDA, NIH, National Science Foundation and National Aeronautics and Space Administration competitive grant programs and on the editorial boards of several prominent reproductive biology and endocrinology journals.

## > Jones named assistant director of natural resources programs



**Michael Jones**

**Michael Jones**, Michigan State University (MSU) fisheries and wildlife professor, was named assistant director of natural resources programs for MSU AgBioResearch (ABR). This is a new part-time position within the organization.

Jones, who served as chair of the Department of Fisheries and Wildlife from 2009 to July 2014 and acting chair in 2008-2009, will be responsible for overseeing ABR research in natural resources. He will work with departments to facilitate research productivity and collaborative opportunities across units.

Jones joins acting associate director George Smith, who in July was appointed to oversee the ABR animal science research portfolio, as well as the Office of Research Support. Smith and Jones will fill the void left when former ABR associate director John Baker was named dean of the College of Veterinary Medicine in June.

Jones received his bachelors of science and Ph.D. degrees, both in zoology, from the University of British Columbia in 1977 and 1986, respectively. In 1997, he came to work at MSU, where he specializes in fish population dynamics and modeling, especially in the Great Lakes, and sea lamprey management. He is co-director of the MSU Quantitative Fisheries Center and is supported by the Great Lakes Fishery Commission through the Partnership for Ecosystem Research and Management (PERM), an agency-university collaboration that addresses significant ecosystem issues through research and outreach.

### > MSU to launch innovative food facility

Michigan State University (MSU) will use a \$3 million grant from the U.S. Economic Development Administration to launch the Food Processing and Innovation Center (FPIC), a USDA/FDA-certified center where private companies can scale up and commercialize new food products and production processes. Efforts are intended to help established food companies develop new products and assist larger-scale start-up businesses.

MSU's Product Center has been working with entrepreneurs over the last decade and understands that there's a strong need for this center and these services, said **Chris Peterson**, director of MSU's Product Center and lead researcher of the new project.

"FPIC will be a distinct asset to support the evolution of food processing in the state of Michigan," he said. "It's the equivalent of a pilot plant that any



**Chris Peterson**

food processor can use to develop new products and production processes."

In addition to the new facility, clients will have access to MSU experts in the fields of agri-business, meat, dairy, and fruit and vegetable processing as well as nationally ranked supply chain and packaging programs.

The center is expected to employ more than 300 persons. It will be located in an MSU-owned building on Hulett Road in Okemos. The renovation will begin in April 2015, and the center will open in early 2016.

### > New microbial risk assessment training program underway

Michigan State University (MSU) AgBioResearch biosystems engineer **Jade Mitchell** is using a \$1 million grant from the National Institutes of Health to develop and provide quantitative microbial risk assessment (QMRA) tools, models and training to university researchers around the nation.



**Jade Mitchell**

One of the goals is to link quantitative scientists such as engineers to biologists and social scientists. QMRA is a four-step process used by scientists and engineers to characterize the human health risk associated with exposure to various microorganisms. The information is used to assess levels of safety and to develop appropriate plans in case of public exposure to infectious agents in all types of settings.

"It's important that we engage more with biologists and social scientists because their work is so important to risk assessment and the application of systems thinking to public health problems," said Mitchell. According to Ajit Srivastava, chair of the Department of Biosystems and Agricultural Engineering, this is the first NIH grant for the department. The grant will boost efforts toward developing engineering systems for One Health, a collaborative, multidisciplinary movement to attain optimal health for people, animals and the environment, he added.

Participants in the two-week courses, set to begin in the summer of 2015, will learn the essentials of QMRA practice and apply their knowledge in cutting-edge real-world case studies. A website, featuring more information including registration forms, is available at [agbioresearch.msu.edu](http://agbioresearch.msu.edu) under the "Researcher Resources" tab.

### > USDA awards MSU \$6.9 million grant to help bees

The U.S. Department of Agriculture's National Institute of Food and Agriculture has awarded \$6.9 million to Michigan State University (MSU) to develop sustainable pollination strategies for specialty crops in the United States.

**Rufus Isaacs**, MSU AgBioResearch entomologist and MSU Extension specialist, is leading the project with the goal of developing and delivering context-specific integrated crop pollination (ICP) recommendations on





Rufus Isaacs

to effectively harness the potential of native bees for crop pollination.

The team will:

- Identify economically valuable pollinators and the factors affecting their abundance
- Develop habitat management practices to improve crop pollination
- Determine performance of alternative managed bees as specialty crop pollinators
- Demonstrate and deliver ICP practices to specialty crops growers
- Determine optimal methods for ICP information delivery and measure ICP adoption
- Analyze economics and modeling of pollination ecosystem services

MSU first received a Specialty Crop Research Initiative (SCRI) grant for \$1.7 million to begin this work in 2012, the final year of the 2008 Farm Bill. This grant will continue and build upon that research to ensure that specialty crop growers are better able to manage pollinators for improved crop yields.

## > Research aims to help biofuel switchgrass survive northern winters

Michigan State University (MSU) plant biologist **C. Robin Buell** has been awarded \$1 million from a joint U.S. Department of Energy and U.S. Department of Agriculture (USDA) program to accelerate genetic breeding

programs to improve plant feedstock for the production of biofuels, bio-power and bio-based products.

Specifically, the MSU College of Natural Science researcher will work to identify the genetic factors that regulate cold hardiness in switchgrass, a plant native to North America that holds high potential as a biofuel source.

"This project will explore the genetic basis for cold tolerance that will permit the breeding of improved switchgrass cultivars that can yield higher biomass in northern climates," she said. "It's part of an ongoing collaboration with scientists in the USDA Agricultural Research Service to explore diversity in native switchgrass as a way to improve its yield and quality as a biofuel feedstock."



C. Robin Buell

One of the proposed methods to increase the biomass of switchgrass, and therefore its utility as a biofuel, is to grow lowland varieties in northern latitudes, where they flower later in the season. Lowland switchgrass is not adapted to the colder conditions of a northern climate, however, and many plants do not survive the winter. In most cases, a small percentage of the plants do make it through the season, and these hardy survivors are the subject of Buell's research.

## > New staff joins U.P. research farm

A farm site at the Michigan State University (MSU) Upper Peninsula Research and Extension Center (UPREC) in Chatham that has not been

used for some 30 years is undergoing a rejuvenation of sorts, thanks in large part to the addition of three staff members and an intern.

New employees **Collin Thompson**, **Brendan Sinclair** and **Liesel McCleary** are working to prepare the North Farm facilities, one of two farm sites at the research center, in anticipation of its opening in 2015. The facilities will include a new incubator farm designed to help local community members learn the latest techniques for farming in the U.P.'s sometimes challenging growing climate.

Thompson, the new farm manager, is responsible for the management of the old farm site revival and its facilities, from deciding which crops to plant to developing educational programs. Sinclair and McCleary are both assistant managers who perform essential functions on the North Farm.

"They had a blank canvas on that farm," said **Ashley McFarland**, UPREC center coordinator. "They've been able to take that and develop the infrastructure and establish a functional operation, and that's a testament to their work ethic and diverse experiences. They're all well-educated, young professionals, and no matter who comes to the farm, they'll learn something from the team."



Collin Thompson



Brendan Sinclair



Liesel McCleary









LEFT: Amber Goguen, a master's degree and doctoral candidate in the MSU Department of Fisheries and Wildlife under the guidance of MSU AgBioResearch professor Shawn Riley, explained that the ultimate goal of her graduate education is to explore how cultural norms and wildlife management systems influence how natural resources are used and shared within communities.

*"...I have heard hunters talk about having a responsibility for the kill — if they shoot the animal, they're committed to using it in some way."*

— Amber Goguen

an increasingly urbanized world can help ensure funding sources for conserving Michigan's unique natural resources.

Goguen uses a research framework called "coupled human and natural systems" developed by MSU AgBioResearch scientist **Jianguo "Jack" Liu**, MSU University distinguished professor of fisheries and wildlife. The approach focuses on the patterns and processes that link human and natural systems, emphasizing the effects of humans on the environment and vice versa. Goguen is identifying the ecosystem services that consuming and sharing venison provide to Michiganders in addition to assessing the effect of these ecosystem services on society. Collecting this data will enable researchers and wildlife management agencies to better understand the suite of benefits hunting provides and to gauge its influence in shaping the public's attitudes concerning the relevancy of hunting.

By surveying and interviewing Michigan deer hunters, Goguen is examining the extent, mechanism and effect of venison sharing on society. She explained that measuring "extent" involves determining how far harvested venison is transported. "Where does it go?" she asks. "How much do the hunter and his/her family consume? Do they give it to relatives? Friends? Food

banks? We want to know about all of the ways that Michigan venison is consumed and shared. We're trying to understand who it's going to and why it's going to that particular person."

The interviews have already begun to paint a picture of what some of the societal effects might be, but Goguen knows there is more work to be done. Two studies from Sweden found that the frequency of wild harvested meat consumption positively influenced attitudes toward hunting. Goguen wants to repeat the studies in Michigan but first needs to better understand the system.

"As a whole, the research findings have generally been pointing to the positive results of deer hunting in Michigan," she explained. A survey of Michigan hunters found nearly half of hunters reported sharing venison in the past 12 months. Another survey found that nearly two out of every five non-hunters had consumed venison in the past 12 months.

"During interviews with Michigan deer hunters, I have heard hunters talk about having a responsibility for the kill — if they shoot the animal, they're committed to using it in some way," she said. "They also benefit from the harvest — they have access to a lean protein source that doesn't cut into their grocery budgets; some

experience spiritual benefits and feel good about being able to support people in their communities by sharing their harvest; others explain that it improves their social relationships because of the bonding that hunting creates."

Goguen said she is grateful for the experience.

"I have really enjoyed working with the graduate students, MSU faculty and the Michigan Department of Natural Resources. The connection between the university and this state agency is truly unique and lends itself to producing interesting, relevant research with direct applications to the conservation of state natural resources."

Goguen is attending MSU on a University Enrichment Fellowship and National Science Foundation Graduate Research Fellowship and has been able to conduct this research with support from the Michigan DNR and the Safari Club International Michigan Involvement Committee. 🌱



## Clarksville Research Center

This center hosts research on small fruits and tree fruits as well as potatoes, chestnuts and a variety of other crops. Research at the 440-acre site includes variety development, fruit thinning and growth regulators, dwarf rootstocks for fruit trees, integrated pest management, organic production systems and new pruning practices to help make production more profitable, efficient and environmentally friendly. Clarksville Research Center is a valuable site for inoculated potato late blight field trials because of its isolation from potato production areas. 🌱

**9302 Portland Road**  
**Clarksville, MI 48815**  
**Phone: 616-693-2193**  
**Faculty Coordinator: Matt Grieshop**  
**Farm Manager: Jerry Skeltis**  
*Established 1974*



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- Specialty areas:**
- Fruit
  - Organic Production
  - Pest Management
  - Potatoes

*MSU AgBioResearch supports a network of campus laboratories and 13 off-campus research centers that provide more than 300 scientists the opportunity to focus their research and outreach activities on the agricultural and natural resource needs of particular regions of the state. The off-campus centers range in location from Chatham in the Upper Peninsula to Benton Harbor in southwestern Michigan. Each is dedicated to high-quality science and innovation that benefit the state and its citizens.*



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