

Legislative Report

2014-2015

A Note from the Directors



Douglas D. Buhler
Director,
MSU AgBioResearch
agbioresearch.msu.edu

It's been a fruitful year for Michigan State University AgBioResearch and MSU Extension. We have seen gains in our external source funding and have expanded our educational connections. None of that would be possible without the important base funding we receive from the Michigan Legislature.

This marks the fourth consecutive year that you have opted to increase our state appropriations. For that, we are truly grateful. Base funding from the legislature gives us the leverage we need to pursue additional funding from partners.

We've hired on-campus faculty to address high-priority issues from antibiotic resistance to food safety. Strengthening investments in quality scientists and educators has resulted in significant increases in external grant funds. And efforts to reinvest in our network of research centers throughout the state, particularly the Upper Peninsula Research and Extension Center in Chatham, along with the Michigan Tree Fruit Commission, continue with success.

We launched the Michigan Alliance for Animal Agriculture, a new partnership to advance the state's animal agriculture economy by addressing such issues as workforce education, nutrient management, profitability, and animal health and welfare.

Additionally, we raised more than \$1 million from farmers, commodity groups and Michigan businesses to build a new 11,000-square-foot educational facility at the Saginaw Valley Research and Extension Center in Frankenmuth. This investment helps to serve as a barometer of the importance of our research and outreach endeavors to the industry.

With your support, we strengthen our partnerships with farmer-led commodity groups and help boost the economic impact and sustainability of agriculture and natural resource businesses in Michigan. We look forward to continuing to generate positive returns on the investment you've made in us.

Thank you for your continued support.

A handwritten signature in black ink, appearing to read 'D. Buhler'.

Douglas D. Buhler
Director,
MSU AgBioResearch

A handwritten signature in black ink, appearing to read 'R. Hammerschmidt'.

Raymond Hammerschmidt
Interim Director,
MSU Extension

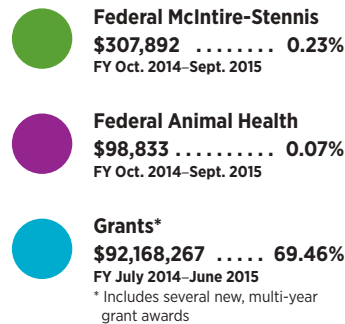
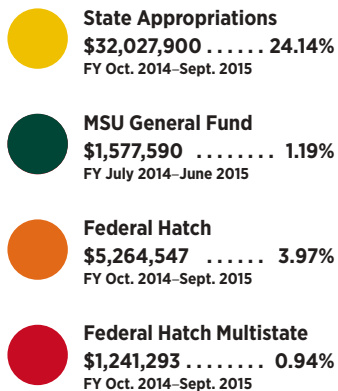
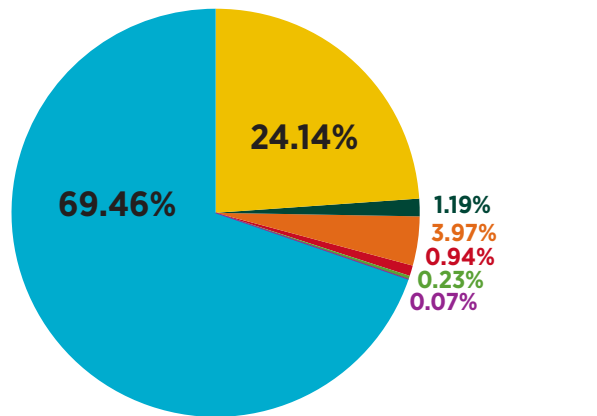


Raymond Hammerschmidt
Interim Director,
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Funding

MICHIGAN STATE UNIVERSITY | AgBioResearch

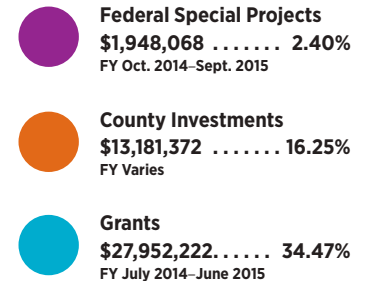
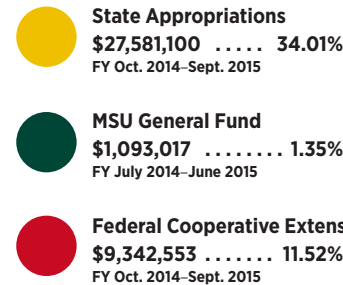
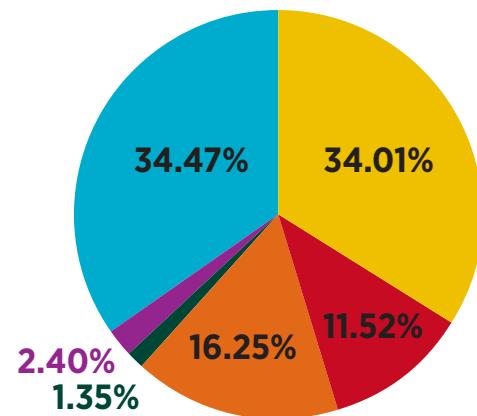
FUNDING FISCAL YEAR 2014-2015



TOTAL: \$132,686,322

MICHIGAN STATE UNIVERSITY | Extension

FUNDING FISCAL YEAR 2014-2015



TOTAL: \$81,098,332

Measuring Our Impact

Connecting with residents

In 2014-15, MSU Extension educators and specialists reached people through:

- ▶ Face-to-face trainings.
- ▶ Online webinars.
- ▶ Social media.
- ▶ Website interaction.
- ▶ Electronic newsletters.

Since its inception more than 100 years ago, MSU Extension has been actively helping people improve their lives by reaching them where they are – in their homes, farms, businesses and communities – with research-driven education.

Through combined face-to face trainings, online webinars, social media, website interaction and electronic newsletters, MSU Extension made nearly 6.4 million connections with Michigan residents in 2014-15. That's an increase of 28 percent over the previous programming year.

MSU Extension's expanded digital reach

From July 1, 2014, to June 30, 2015:

- ▶ 2.5 million visitors viewed more than 5.3 million web pages.
- ▶ 751,000 topic newsletters were distributed to more than 10,400 email addresses.
- ▶ MSUE Extension reached more than 2,500 Facebook and more than 2,200 Twitter followers.

More than 143,000 adults and 182,000 youth participated in MSU Extension programming from July 1, 2014, to June 30, 2015.

In that same time period, more than 2.5 million people viewed more than 5.3 million pages of rich, science-based content on the MSU Extension website (*msue.msu.edu*). Of those, 52 percent were first-time visitors. Search engine rankings help make *msue.msu.edu* one of the most visited Cooperative Extension Systems education sites in the country.

MSU Extension distributes a series of electronic newsletters that cater to residents' interests. Each month, nearly 751,000 topic-specific newsletters are distributed to about 10,400 email addresses. This 34-percent increase over the previous year shows that



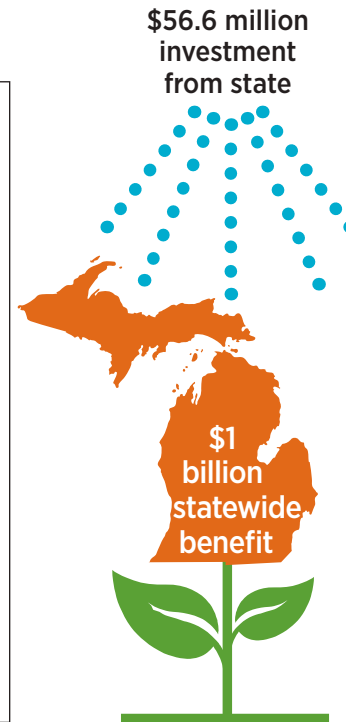
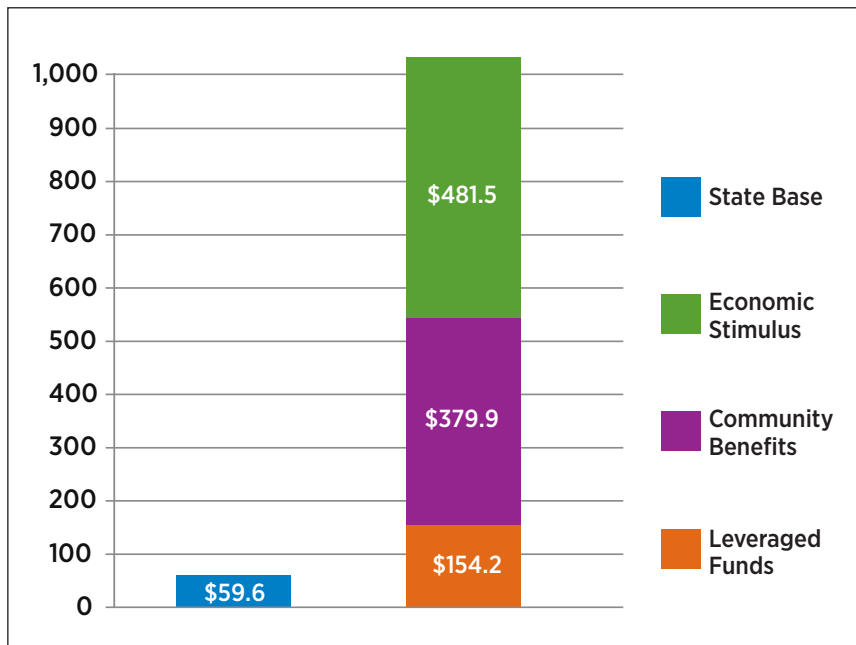
people continue to be hungry for information delivered to their mobile devices, tablets and desktop computers.

MSU Extension uses social media channels to reach people with educational content. Currently, Extension professionals reach more than 2,500 Facebook followers and more than 2,200 Twitter followers. In addition, Michigan 4-H families and volunteers stay informed about activities through social media channels, including Michigan 4-H Facebook with 3,125 likes.

Leveraging state funding

The state's \$56.6 million investment in MSU AgBioResearch and MSU Extension generated a total impact of **more than \$1 billion** for Michigan residents in 2014-15.

MSU AgBioResearch/MSU Extension Leverage Economic Stimulus and Community Benefits (millions of dollars)



Economic analysis by Steven R. Miller, Center for Economic Analysis, MSU Department of Agricultural, Food and Resource Economics

Every dollar the state invested in MSU AgBioResearch and MSU Extension resulted in:

- ▶ **LEVERAGE** of an additional \$2.59 in federal funds and external contracts, grants and other revenues to serve Michigan residents.
- ▶ **COMMUNITY BENEFITS** worth an additional \$6.37 to the state and nation.
- ▶ When the leveraged funds and community benefits are added to the initial investment, they yield a net **ECONOMIC STIMULUS** valued at nearly \$481.5 million in state economic activity and state tax revenues.
- ▶ Combining the above effects, along with the additional tax revenue, returns to the state economic and social benefits in a **BENEFIT/COST RATIO** of 18:1.
- ▶ Continuing to invest in MSU AgBioResearch and MSU Extension is vital to the state's economy, our communities and our residents.

Photo: NASA

Increasing consumer confidence with Breakfast on the Farm

- ▶ Participants having a high or a very high level of trust in modern food production shifted from 66% before they took the dairy farm tour to 91% after the tour.
- ▶ Attendee levels of trust in milk as a safe food shifted from 80% with a high or a very high level of trust to 97% with a high or a very high level of trust after they took the tour.
- ▶ Consumer trust that farmers will do the right thing in caring for food-producing animals shifted from 76% before the tour to 97% after.

In today's information-hungry world, consumers often come across misinformation and speculation. Breakfast on the Farm aims to help clear up misconceptions about food production by offering families an opportunity to tour modern farms and meet the people who produce their food.

Breakfast on the Farm gives families a first-hand look at how farmers deal with environmental and animal well-being issues. The events spark open conversations between the numerous farmer-volunteers and consumers. The program, coordinated by MSU Extension and supported by numerous Michigan agricultural organizations, has reached more than 62,000 consumers since its inception in 2009.



Photo: ANR Communications

Fueling the economy

In 2014-15, MSU Product Center professionals conducted 5,996 counseling sessions with 625 clients, resulting in:

- ▶ More than \$8.2 million in total capital formation, including more than \$7 million of owner investment in Michigan businesses.
- ▶ 61 new ventures launched.
- ▶ 175 jobs created or retained.



Food and agriculture continue to be a driving force in Michigan's economy. An MSU Product Center Food-Ag-Bio report shows that the entire food and agriculture system generates more than \$106 billion of economic activity in Michigan annually.

Since it was established in 2003, the MSU Product Center has been demonstrating how entrepreneurs can successfully work with university professionals to identify markets, innovate new products and make critical decisions from product concept to launch. The center's statewide network of counselors helps budding and established businesses develop and commercialize high-value, consumer-responsive products in the agriculture and natural resource sectors.

MSU Product Center Clients Served

2012-13



2013-14



2014-15



Production Agriculture

Accelerating fruit breeding research through genetic technology

Producing varieties that display the hallmarks of healthy fruit is a slow process, often spanning decades. MSU plant geneticist Amy lezzoni is working to help breeders take advantage of the wealth of fruit genetic knowledge that has emerged in the last decade. Her work has accelerated fruit breeding programs across the country and allowed even the most stubborn traits to be improved.

lezzoni began the RosBREED project to help breeders working with the *Rosaceae* family (which includes apples, peaches, sweet and tart cherries, raspberries, plums, pears and strawberries) incorporate the latest genetic knowledge and tools in their work. They have allowed producers to create new varieties of fruit more quickly and less expensively than ever before, and are now focusing on improving disease resistance across *Rosaceae*. By applying the latest genetic tools and knowledge, lezzoni's team will be able to reduce the crops' vulnerability and keep producers' livelihoods and the nation's food system more secure.



Photo: MSU AgBioResearch

▶ Developing a new apple or cherry variety through traditional means can take between 15 and 25 years.

▶ RosBREED was refunded this year through a \$10 million USDA grant.

▶ Michigan *Rosaceae* crops are valued at nearly \$230 million.

Educating the new face of farming: Women



Photo: ANR Communications

Farm women come from diverse backgrounds. Some marry into the business with little agriculture experience, while others tout a lifetime of involvement on family farms. Regardless, being a woman in a male-dominated business can be challenging. Through Annie's Project, MSU Extension staff members empower women to become successful entrepreneurs while building a network of like-minded women.

While learning about the crucial and complex business environment of their own farms, Annie's Project participants grow in confidence, business skills and community prestige.

Attendees of past programs represented a variety of farm businesses including beef, dairy, swine, vegetables, fruit and cash grain crops. In the past year, participants' farms comprised 15,685 acres farmed.

Participants reported that their:

▶ Overall farm business knowledge level increased from 37.5% to 76.5%.

▶ Knowledge level of property ownership increased from 11.1% to 65.4%.

▶ Knowledge level of estate planning went from 0% to 76.5%.

Building leaders in agricultural production and ingenuity

By applying for and receiving grants totaling \$40,000, MSU Extension was able to bring this exciting program to Michigan, resulting in:

- ▶ 43 youth becoming trained as teen leaders in the Ag Innovators Experience. These youth developed expertise in program concepts while delivering 59 challenges across the state and developing important leadership skills.

- ▶ 2,313 youth participating in Ag Innovators Experience challenges, enhancing their interest in and knowledge about science and agriculture careers.

- ▶ Two participants taking part in an urban challenge and winning a national video contest about their experience.

Due to our rapidly growing population, the need to produce more food becomes critical. With a finite amount of land and resources on which to produce this food, advancements in food production must come from new and innovative agricultural practices that allow farmers to produce more with less. To help prepare a capable future workforce interested in tackling this issue, the 4-H Ag Innovators Experience was created.

A national program, the 4-H Ag Innovators Experience trains teen leaders on simulated agricultural problems, such as fish farming or water use. These leaders run challenge activities for other young people.



Photos: ANR Communications



Using a virtual classroom to teach new farmers

- ▶ Participants represented 54 counties in Michigan, 12 states and three countries. More than 1,800 webinar views were recorded for the 2015 series.

- ▶ 97 percent of respondents indicated that the series was valuable to their education.

Michigan residents interested in engaging in new agricultural enterprises sometimes lack knowledge, experience and technical support to get started. MSU Extension educators and specialists receive numerous inquiries seeking basic, startup information for beginning farmers. Since 2012, they have filled this need through the Beginning Farmer Webinar Series.

In 2015, 23 MSU Extension educators taught 20 educational webinars. Topic-specific webinars included hops production, marketing, beekeeping, cover crops, organic certification, mortality management, vegetable production, sheep and goat production, cow-calf production, farm food safety, pest management, irrigation, fruit production and poultry production. Participants were mostly current or future growers who represented small farms. Four percent of the participants said they were not currently farming.

Delaying fruit bloom to avoid severe frost damage



Photo: MSU Communications & Brand Strategy

Tree fruit in the Great Lakes region is especially vulnerable to cold damage in the spring after trees break out of dormancy. Unfortunately, the number of spring freezes following initial fruit development in the region has increased in recent decades.

MSU horticulture professor Jim Flore is examining mist cooling to delay bloom and reduce the risk of frost damage in apples and cherries. Applying water with conventional sprinkler systems during the late stages of dormancy and early vegetative stages has been shown to reduce vulnerability to frost damage by cooling the plant tissue and delaying growth and development. Flore is studying the effectiveness of a new spray technology called solid set canopy delivery systems (SSCDs), used in high-density orchards for application of fertilizer and other sprays, to finely mist the trees to reduce the risk of cold-related damage.

Thus far, the SSCDs results are encouraging:

- ▶ Mist applications during the two growing seasons delayed bloom of apple and cherry by five to 11 days on average.
- ▶ Spring frost damage was less.
- ▶ No increased disease or fruit set problems occurred.
- ▶ The SSCDs used far less water than conventional sprinkler systems.

Helping farmers navigate farm bill programs



Photo: ANR Communications

New programs in the 2014 farm bill require farmers to make complicated business decisions. MSU Extension collaborated with the Michigan Farm Service Agency (FSA) to help farmers sort through their options. Because of the complexity of the bill's commodity, noninsured crop disaster assistance programs and crop insurance programs, this collaboration is essential to provide accurate information to producers.

Close collaboration between MSU Extension and the FSA helps producers work through the best program choices for their operations. This approach provides an easy-to-access source of information for producers through meetings and an MSU Extension website dedicated to continuing farm bill education.

▶ MSU Extension worked with FSA and farm and commodity organizations to host 100 regional informational meetings for nearly 8,000 producers, representing a majority of the farm acreage in Michigan.

▶ Better informed producer decisions will improve farm financial success during the 2014-2018 period.

Improving wine grape production with innovative viticulture techniques

So far, Sabbatini has:

- ▶ Explored and developed viticulture techniques that keep grape clusters on vines longer during the wet, rainy period at the end of the season.
- ▶ Found that removing the leaves around flower clusters at bloom time results in less-dense grape clusters, and subsequently, grapes that are not as susceptible to cluster rot.
- ▶ Begun to develop pruning techniques that allow growers to maintain yield while reducing cluster density.
- ▶ Lowered humidity and increased the opportunity for more sun exposure inside clusters.

As the fourth largest grape-producing state in the U.S., Michigan is home to more than 15,000 acres of vineyards that fuel a \$790 million industry. The Michigan Grape and Wine Industry Council explains that a tremendous growth in sales and production of Michigan wineries has created demand for high-quality, Michigan-grown grapes that is challenging to meet. Growers must overcome cold winters and cool, wet summers, which take a severe toll on vines and encourage diseases that detract from producing the perfect bottle of wine.



Photo: MSU Communications & Brand Strategy

Paolo Sabbatini, MSU associate professor of horticulture, is addressing this problem by developing viticulture techniques that alter grape cluster microclimates, thwart disease and improve Michigan grape quality.

Preparing the next generation of dairy farmers

In the past year:

- ▶ Nearly 2,750 4-H youth participated in dairy science projects in 58 counties.
- ▶ 89% of the more than 220 potential dairy professionals who took part in 4-H Youth Dairy Days reported they felt more knowledgeable about dairy science.
- ▶ 98% of the more than 50 youth who attended the Michigan 4-H Dairy Conference said they plan to apply the knowledge and skills they learned.

As the leading segment of Michigan agriculture, dairy contributes more than \$14 billion to the state's economy annually. MSU Extension programs work with youth to ensure this critical economic sector continues to grow and thrive.

To help ensure the strength and longevity of dairy production, and to prepare young dairy farmers for success, MSU Extension offers youth interested in the dairy sector a continuum of learning opportunities. These opportunities range from instructive events such as the Michigan 4-H Dairy Conference and the 4-H/MMPA Milk Marketing Tour, to educational contests such as 4-H Youth Dairy Days and numerous judging competitions. These experiences, along with county 4-H dairy science projects, educate youth about the dairy industry and prepare them for careers in this important sector.



Photo: ANR Communications

Producing high-yield soybeans on irrigated soils

Irrigation has not consistently increased soybean yields. In fact, non-irrigated yields have equaled or exceeded irrigated yields in some cases. The Michigan Soybean Promotion Committee (MSPC) has identified irrigated soybean production as a high priority.

MSU Extension led a cooperative effort to plan, promote, conduct and evaluate a high-profile, multi-state educational program held in conjunction with Purdue University Extension, the MSPC and the Indiana Soybean Alliance. More than 160 soybean producers and agronomists from Indiana and Michigan participated in the program.

Key soybean producers, industry representatives and Extension personnel met at the conclusion of the program to identify educational needs required to improve irrigated soybean production. Two topics were identified: white mold management and irrigation water management. A follow-up multi-state program was planned, promoted and conducted in 2015 to address these issues.



Photo: ANR Communications

- ▶ 75% of the participants utilized or implemented the new information they learned in 2014.
- ▶ 52% of the participants actually earned additional money by implementing the new information.
- ▶ The average amount of additional income was \$13.15 per acre. The total financial impact of the program was \$93,010 in 2014 alone.

Protecting Michigan crops from dangerous pathogens



Photo: MSU Communications & Brand Strategy

Michigan is a leading producer of vegetable crops in the nation. Vegetable growers must contend with an increasing number of bacterial and fungal pathogens that threaten to contaminate their fields and destroy their crops. MSU plant pathologist Mary Hausbeck is giving them the tools they need to safeguard the food supply.

Hausbeck's lab develops strategies and techniques for Michigan growers to use against a wide array of vegetable pathogens. Her team was instrumental in eliminating the threat of anthracnose, a fungal pathogen that was detected in Michigan in 2010 and was found nowhere else on earth, as well as in saving the Michigan impatiens industry from a type of downy mildew that could survive the winter months. Hausbeck is currently developing management strategies for downy mildew in cucumbers, which recently became resistant to many conventional fungicides. The team is also working to combat onion leaf blight, which first appeared in 2011.

- ▶ Michigan vegetable production represents a more than \$255 million industry.
- ▶ Nearly 3,000 Michigan farms and 112,000 acres are dedicated to vegetable production.
- ▶ Onion leaf blight afflicted an estimated 35 percent of Michigan onion crops last year.

Redesigning genetic technology to cut costs, improve accessibility

- ▶ The low-density SNP chip costs a half to a third as much as a high-density version and retains 98% of its genetic prediction capability.
- ▶ The Michigan pork industry is valued in excess of \$362 million.
- ▶ Pork is the third most popular meat in the United States.

For the past six years, MSU animal scientist Juan Steibel and his collaborators have been developing a cost-effective tool to analyze specific elements, called single-nucleotide polymorphisms (SNPs), within a pig's genetic code. The device, called a SNP chip, probes each SNP in a tissue sample with fluorescence technology. The probes glow different colors denoting which SNPs are present, allowing the user to fully characterize an individual pig's entire genotype.

Most SNP chips are high-density, meaning they target over 50,000 SNPs in order to produce the full pig genome. While effective, these devices are often too expensive for breeders to apply to large numbers of animals, which limits the size of the dataset, and, therefore, its usefulness in terms of creating a breeding strategy. Steibel hopes to change that by refining the technology and producing a low-density SNP chip that can yield the same quality of information at a significantly reduced cost.



Photo: MSU Communications & Brand Strategy

Shielding the fruit industry against tiny fly that is big trouble

In partnership with several MSU AgBioResearch scientists and MSU Extension specialists, Isaacs has:

- ▶ Supplied Michigan growers with information on the most effective insecticides, sprayers and nonchemical controls to limit SWD.
- ▶ Committed to continue identifying biological controls and biopesticides, and to developing additional control methods.
- ▶ Brought growers and consultants together for hands-on demonstrations and presentations on the latest research and management techniques.

Michigan's fruit industry boasts more than 22,000 acres devoted to small fruit production; blueberries account for a whopping 20,900 of those. Valued at \$118.5 million, the blueberry industry has helped Michigan gain a reputation as a top producer of one of the world's most popular fruits.

In 2010, MSU researchers confirmed the presence of a pest that threatened the future of this industry: spotted wing drosophila (SWD). Since its arrival in the eastern U.S., growers of most berry crops have spent millions of dollars managing the invasive pest. SWD cuts its way into fruit while it's still intact on the tree, creating a scenario where larvae could be inside fruit at harvest, compromising fruit quality.

Rufus Isaacs, MSU professor of entomology, has been leading a grower-centered response to the threat of SWD in Michigan.

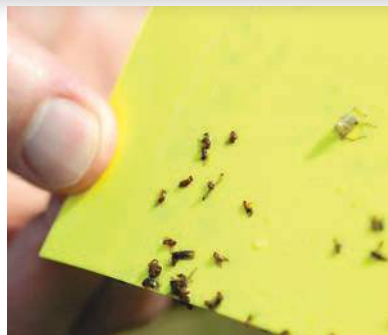


Photo: MSU Communications & Brand Strategy

Community & Economic Development

Brewing new businesses through Great Lakes Hop and Barley Conference

The inaugural Great Lakes Hop and Barley Conference (GLHBC) took place in Grand Rapids Michigan, drawing more than 350 participants. MSU Extension, MSU AgBioResearch and the Michigan Brewers Guild coordinated the event.

The GLHBC consisted of three concurrent sessions: the Hop Introductory Track, the Hop Advanced Track, and the Barley and Malt Track. The conference drew attendees from Alabama, Illinois, Indiana, Iowa, Maryland, Nebraska, New York, Ohio, Washington and Wisconsin, and from Ontario, Canada. Male attendees represented 82 percent of the audience; females represented 18 percent. Attendees estimated their agricultural land impact to be 2,397 acres and the estimated farm gate value of agriculture-related products to be \$276,000.



Photo: Erin Lizotte, MSU Extension

► 91.3% of participants in the Hop Introductory Track session said they plan to use MSU Integrated Pest Management (IPM) resources.

► 100% of participants in the Barley and Malt Track session said they will be using MSU Malting Barley online resources, along with 90.9% planning to use the MSU Malting Barley Variety Trial Data.

► 83.9% of participants in the Hop Advanced Track session plan to use MSU IPM online resources.

Increasing educational opportunities at new research center building



Photo: MSU AgBioResearch

More than \$1 million in contributions from agriculture industry groups and Michigan businesses has been raised to help MSU broaden its impact in the greater Saginaw Valley community. The donations are being used to build a new 11,000-square-foot educational facility on the property at the Saginaw Valley Research and Extension Center (SVREC).

Plans for the SVREC Agricultural Education Center include a 250-person meeting room, a 50-person classroom for hands-on learning activities, on-site offices and a multipurpose reception space for events or educational displays. The center will also feature tours that showcase current research.

Since 1971, MSU has operated a research center in the Saginaw Valley area, home to most of the dry bean and sugar beet production in Michigan. In 2008, the center moved from Saginaw to Frankenmuth, more than doubling the acreage of the SVREC. More land has since been acquired, bringing the total to 310 acres.

► Michigan is the No. 1 producer of black beans in the United States.

► Michigan is the No. 3 producer of sugar beets.

► Other crops studied at the SVREC include corn, wheat and soybeans.

Implementing a plan to drive tourism beyond marketing

Goals of the plan include:

- ▶ Foster a culture of public-private collaboration, cooperation and partnerships to continue to unify the tourism industry and help grow Michigan's economy.
- ▶ Enhance infrastructure to support the delivery of a world-class Pure Michigan travel experience.
- ▶ Strengthen and grow the Pure Michigan brand through media at the regional, national and international levels to attract first-time and repeat visitors.

In an effort to continue to grow tourism and statewide economic impact, Sarah Nicholls, an MSU associate professor in the departments of Community Sustainability and Geography, has led the development of and is now implementing the 2012–2017 Michigan Tourism Strategic Plan.

More than 900 people from tourism industry sectors across Michigan helped develop the plan. Implementation includes uniting diverse groups involved in tourism from lodging, attractions and events, and transportation industries to convention and visitor bureaus, food and beverage providers, and retailers.

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 inform public policy and provide small business owners with useful findings.



Building strong communities with homeownership education

In 2014, of respondents reporting:

- ▶ 92% said they now had the ability to understand predatory lending practices.
- ▶ 90% said they now could identify the best mortgage for their needs.
- ▶ 86% said they now could calculate a reasonable monthly housing budget.
- ▶ 86% said they now had the ability to save money to prepare for homeownership.

Strong homes make strong communities, and strong communities make a stronger Michigan. Unfortunately, many struggling Michiganders are intimidated or unsure about the home-buying process, and too often those facing the possibility of foreclosure are unsure of where to turn for help.

MSU Extension has Michigan State Housing Development Authority–certified counselors who work one-on-one with homebuyers or those interested in purchasing a home. Studies show that one-on-one pre-purchase counseling gets buyers into lower cost mortgages, improves credit scores, reduces defaults and increases the likelihood troubled borrowers will seek foreclosure prevention assistance.

In 2014, 40 percent of the 419 homeownership education participants reported an annual income below \$30,000.



Building the future workforce

For many youth, a part-time or summer job provides an opportunity to explore potential career fields while developing important real-world skills they can utilize in the future. However, research indicates youth participation in the workforce has been on a steady decline for years. Without job experiences, today's youth must find new ways to uncover career interests and cultivate the critical occupational skills employers need.

With the use of its National 4-H curriculum *Build Your Future*, MSU Extension is helping to do just that. The *Build Your Future* curriculum helps teens learn about their options, make important connections and plan meaningful careers. Teens learn how to identify goals, investigate interests, develop employable skills, and explore post-secondary education options and funding sources.



Photo: ANR Communications

In 2014-2015:

- MSU Extension trained 227 teachers, volunteers and other professionals on *Build Your Future*. These adults will deliver the curriculum to youth, raising the impact of Build Your Future exponentially.

- Trained adults in the *Build Your Future* curriculum began piloting curriculum activities with youth, with 100% of those surveyed agreeing the lessons helped young people develop informed career goals and basic knowledge about employment skills.

Building responsible and informed Michigan residents



Photo: ANR Communications

Though today's youth learn a great deal about the democratic process at the federal level, very little time is spent on the legislative system at the local level – with few resources spent learning about state and regional legislative processes. Despite this, local and state politics play a pivotal role in everyday life, and an understanding of these systems is critical to building active and engaged agents of positive change.

To address this issue, MSU Extension offers programs and resources to help young people know and understand the policymaking process from the ground up. Through programs such as 4-H Capitol Experience, which this year gave 100 youth a hands-on look at the state Legislature, and 4-H Citizenship Academy, which in 2015 provided 38 young people with an in-depth look at local county and tribal governments, youth develop knowledge of how legislative systems operate and learn skills to influence public policy.

After participating in these programs:

- 95% of surveyed Capitol Experience participants feel prepared to work toward change in their communities, compared to just 60% before the event.

- 75% of Citizenship Academy participants were willing to work in government jobs and 50% were interested in running for public office.

Making farm to fork a reality

In 2015, MSU Extension evaluated key partners in food and farming business development and found:

- ▶ \$2.7 million in funding for food organizations leveraged through working with MSU Extension.
- ▶ 82% said they had increased knowledge of sustainable agriculture.
- ▶ 74% said they received valuable business concepts and tools.
- ▶ 67% said they were made aware of increased market options.

Whether you call it farm to fork, farm to institution or just good old-fashioned business development, MSU Extension is helping forge sustainable and growing local food systems, through connecting farmers and consumers.

While “more local food” is a popular mantra, MSU Extension has the expertise, talent and local ties to bring important stakeholders together, make small farm and food businesses more profitable, and increase the local foods in Michigan organizations, homes and businesses.

MSU Extension educators focused on local food businesses and community food systems leverage their knowledge of the food chain, local food resource needs and business and community connections to create local food hubs, strengthen their local food systems and forge connections between local growers and organizations interested in adding more Michigan-made products to their schools, cafeterias and restaurants.



Providing Master Gardener training to thousands

- ▶ There are 2,909 MSU Extension Master Gardeners currently located in 77 different counties.
- ▶ 450 new volunteers are being trained across 41 different counties.
- ▶ Master Gardeners provided 164,986 volunteer hours, totaling an economic value of \$3.7 million in 2014.

The MSU Extension Master Gardener Program provides Michigan residents with the most current and environmentally sound horticulture information available. The program recognizes participants' contributions to their communities and supports efforts that improve Michigan communities, families, adults and children.

The program provides interested individuals with an opportunity to engage in a focused, 13-week training experience that provides in-depth education in many aspects of horticulture, including trees and shrubs, flowers, vegetables, fruit, soil, water, pests, indoor plants and lawns. Participants who complete the training showcase what they learned through volunteer projects. Focus areas for volunteer projects are environmental stewardship, improving food security, improving community, and youth development through gardening.



Photo: ANR Communications

Environmental Quality & Natural Resources Management

Celebrating 25 years of advancing Great Lakes literacy

Michigan is the Great Lakes State, yet Great Lakes literacy among both youth and adults is low and physical access to the lakes is a challenge for many Michigan residents.

Michigan Sea Grant Extension is a leader in Great Lakes literacy and science education, helping to create a network of educators and informed citizens who share their knowledge of and commitment to Great Lakes stewardship with others. The Great Lakes Education Program has provided classroom and vessel-based education for K-12 students in southeastern Michigan since 1991. More than 85,000 students and 15,000 adults have participated – many experiencing the Great Lakes for the first time.

The program includes classroom lessons and an entire day in the field. In 2014 alone, the Great Lakes Education Program involved schools from four counties and 26 school districts and included 3,470 students, 116 teachers, 476 adult chaperones and 42 volunteer educators, who donated 725 hours toward program delivery valued at \$16,348.

Student evaluations demonstrate a high confidence in science knowledge and an affinity for science after taking part in the program.



Photo: Michigan Sea Grant

Teacher evaluations show:

- ▶ 93% feel a greater responsibility for the Great Lakes.
- ▶ 74% include more Great Lakes content in their classrooms.
- ▶ 21% engage their students in Great Lakes stewardship activities.

Assisting biologists using citizen scientists

- ▶ In 2014, 125 anglers signed up to be salmon ambassadors.
- ▶ Volunteers recorded data on 3,460 salmon.
- ▶ Ports around Lake Michigan reported 57 to 75% of caught chinook salmon were wild, while volunteers in northern Lake Huron reported 82% were wild.

Michigan Sea Grant Extension has a long history of assisting the Great Lakes sport fishing industry. Educators gather industry information through surveys, offer fisheries workshops and recruit anglers to be citizen scientists. Today, Michigan's recreational fisheries industries are valued in excess of \$4 billion annually.



Photo: Michigan Sea Grant

The Great Lakes salmon stocking program began in 1966 and for years, anglers and biologists lived by a simple equation: more fish stocked equals more fish caught. But when chinook salmon catches dropped off, biologists realized they had come close to the limit of salmon the lakes could support.

Thanks to a citizen science project led by Michigan Sea Grant Extension, anglers now share critical information on their catches. Salmon ambassador volunteers track each chinook salmon they catch and report whether it was a wild or stocked fish. Understanding how stocked fish contribute to the catch helps managers make informed decisions regarding the future of salmon stocking in lakes Michigan and Huron.

Finding economic future in Michigan's fish heritage

- ▶ The summit brought together presenters from MDARD, MDEQ, MDHHS, MSU, community colleges and the private sector, as well as award-winning chefs.
- ▶ More than 100 people attended each of the presentations.
- ▶ Media coverage spread the message far beyond the summit.

Michigan produces significant amounts of seafood through aquaculture and commercial fisheries. However, the public generally remains uncertain about the safety of eating Great Lakes fishes, and many people question the sustainability of wild-caught fishery products. As Michigan sits at the heart of the Great Lakes and freshwater is an abundant resource, a strong aquaculture and commercial fishing industry could help feed many in the region and beyond.

To help strengthen the fisheries industries and to raise public awareness, Michigan Sea Grant coordinated the first-ever Michigan Seafood Summit in March 2015. Sessions focused on sustainable seafoods, creating a cohesive fisheries network, aquaculture, seafood safety and more. The history of fisheries in Michigan, and lessons that can be learned from the past and used in the future of seafood marketing, were part of the keynote address. A highlight of the event was a five-course banquet featuring seafood from Michigan.

Measuring walleye population changes in Michigan's inland waterways

Valued for their large size and excellent flavor, walleye rank as one of the most popular species of fish in Michigan. In 2009, the Michigan Department of Natural Resources (MDNR) discovered that walleye in the Inland Waterway, a network of lakes and rivers spanning private, public and Native American tribal land in Cheboygan County, had greatly diminished since they were last surveyed in 1998. Returning the population to a sustainable level became a priority. Through the efforts of MSU fisheries scientist Daniel Hayes, the MDNR and tribal fisheries managers are making better, more informed decisions to help the species recover.

Hayes's team used a variety of techniques, including tagging, stable isotope analysis and environmental assessment to build an understanding of the threats facing the species. With a more complete picture of the fishery in hand, both MDNR and the tribes are able to make more informed decisions regarding this shared resource.



Hayes's team discovered that:

- ▶ 80% of adult walleye travel widely through the lakes of the waterway during the summer months.
- ▶ Juvenile walleye have new competition for food from invasive species like zebra mussels.
- ▶ MDNR population estimates last year indicated many more young walleye survived than previous years.

Expanding online access to IPM Academy

The Integrated Pest Management (IPM) Academy Online has proven to be a great new avenue to access stakeholders, particularly underserved audiences. MSU Extension expanded the offerings in 2014 and plans to continue the expansion in 2015 to include at least a dozen new webinars. Between October 2013 and August 2014, 1,663 webinar sessions were viewed. More than 1.2 million acres were impacted as a result of 439 unique online visitors who learned more about IPM and the resources available to adopt IPM practices on their lands. This is the first program of its kind to offer Restricted Use Pesticide (RUP) credits in Michigan.

After viewing the webinar:

- ▶ 93.7% of participants had a better understanding of IPM history.
- ▶ 81.2% of attendees intend to increase their adoption of IPM strategies.
- ▶ 95.8% of participants have a better understanding of where to find resources related to the adoption of IPM.

Shedding light on the importance of tree diversity

In partnership with the MDNR and industry foresters, Walters has:

- ▶ Identified factors that reduce tree diversity and is searching for realistic ways to restore it.
- ▶ Found that tree regeneration is dominated by ironwood and beech because deer only eat these species when other options are unavailable.
- ▶ Concluded that greater tree diversity makes forests more resilient to invasive pests and acts as an economic buffer against changes in market demand.

More than half of Michigan's 36.3 million acres is forestland. Michigan's state-owned forest system, managed by the Michigan Department of Natural Resources (DNR), is nearly 4 million acres — larger than any other state-owned system in the U.S. In addition to the recreational, tourism and indirect economic benefits derived from this natural resource, Michigan's forests support more than 13,000 timber and wood product jobs and more than 2,200 companies.

Michigan forests, however, have unique problems. MSU forest ecologist Mike Walters studies factors negatively affecting forests, especially the nearly 7 million acres of northern hardwood forests in the Upper and northern Lower Peninsula. The legacies of past forest harvesting practices and high deer populations combine to contribute to low tree diversity and the perpetuation of only a few tree species in these forests.



Photo: MSU AgBioResearch

Improving soil health through long-term study

- ▶ Over 2.5 million acres of Michigan farmland are dedicated to corn production.
- ▶ Corn yields are 13% to 19% higher after a rotation of soybeans in the same plot.
- ▶ In 2012, Michigan farmers sold over \$2 billion in corn.

The Living Field Laboratory (LFL) was established in 1993 as a long-term study of the potential benefits of including cover crops in the rotation cycle of corn. The first crops were planted in 1994. Crops planted there since have been observed for 20 years.

Now, MSU agronomist Sieg Snapp and her research team are comparing the crops and soil of the LFL plots. Though the data is still being analyzed, the benefits of crop rotation are apparent. Crop rotation helps increase the amount of organic matter in the soil. This improves the soil's ability to filter and retain water, which allows it to remain productive during periods of drought. It also improves the soil's ability to release nitrogen efficiently, reducing reliance on fertilizers. The research shows that rotating crops and using reasonable levels of fertilizer could bring about beneficial changes in soil composition.

Deciphering the uptake and metabolism of sulfur in plants

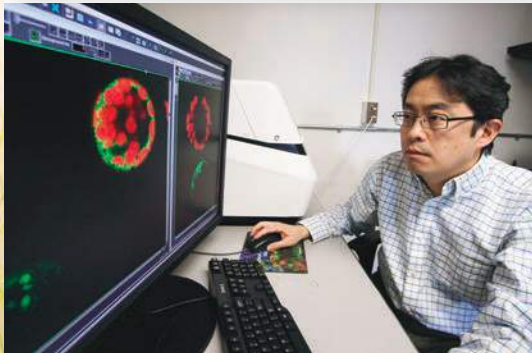


Photo: MSU AgBioResearch

Hideki Takahashi, MSU biochemist, is uncovering insights into the uptake and metabolism of sulfur, an agriculturally important macronutrient. His long-term goal is to help plants be more efficient at sulfur uptake, thereby reducing farmers' reliance on certain fertilizers. His research will also enable scientists to isolate and synthesize sulfur-containing metabolites essential to human and plant health.

A key component of crop nutrition involves assessing and enhancing soil health. According to the U.S. Department of Agriculture, in 2013, U.S. farmers spent more than \$11.3 billion on fertilizers to boost soil fertility.

Many growers are burdened by the high cost of fertilizers and have concerns about their environmental impact. Often, nutrients not absorbed by crops leach into the surrounding water and soil systems, becoming a source of pollution that affects all components of the ecosystem.

To date, Takahashi and his team have:

- ▶ Identified a transcription factor that activates expression of sulfate transporters in plants, which allows researchers to determine how sulfate transporters can be overexpressed in plants.
- ▶ Cloned and characterized many sulfate transporters in the model plant *Arabidopsis thaliana*.
- ▶ Uncovered which sulfate transporters are expressed in specific cell types and membrane systems.

Improving ecology research with 'big data'

Researchers now have access to larger data sets than ever before, spanning institutions, regions, nations and continents. These vast data sets, or "big data," promise to open up new levels of scientific analysis and help scientists answer questions about how large systems function and change. MSU researchers, led by Patricia Soranno, are applying this new frontier of knowledge to the field of ecology.

Soranno's team is using big data to study freshwater quality, and the factors that influence it, across the U.S. By studying the full range of lakes, they are working to understand their diversity and why some might be more prone to water-quality issues than others. Bringing big data research into ecology helps researchers investigate issues beyond just water quality. By studying lake systems as a population, researchers can also gain insight into their significance to climate change and the global carbon cycle.

Soranno's team has so far pioneered:

- ▶ A new subfield of ecology, macrosystems ecology, which incorporates big data alongside traditional ecological research.
- ▶ New teamwork models that help researchers act as a collective unit.
- ▶ Interdisciplinary collaboration with computer scientists and analysts to study the massive diversity found in big data sets.

Photo: MSU AgBioResearch

Food Safety & Security



Increasing food safety of chipping potatoes

▶ 75% of all potatoes grown in Michigan are destined for potato chips.

▶ The impact of the new audit requirements affected over 10,000 acres and annual sales in excess of \$40 million. (This was calculated assuming a price of \$11.60 per hundredweight and an average yield of 345 hundredweight per acre.)

▶ One in every five potato chips produced by this international manufacturer will be grown under these food safety practices.

Michigan leads the nation in chipping potato production. In recent years, concern for food safety has become more acute on the part of all sectors of the food system. Chipping potatoes are no exception. This concern has led buyers to demand new audit requirements of their suppliers.

After a prominent international chipping potato manufacturer required all growers to be audited as a prerequisite of sale, a group of growers turned to MSU Extension for help. A worker training program was developed that included a robust food safety manual and a digital recordkeeping system that ensured compliance and simplified recordkeeping.



Photo: ANR Communications

Commercializing biosensor technology



Photo: MSU AgBioResearch

Millions of Americans with diabetes use a variety of meters to check their blood glucose levels and manage the disease. This is spurring MSU scientists R. Mark Worden and Paul Satoh to commercialize a biosensor system that would have widespread applications in other venues, such as food processing facilities or clinical laboratories that assess high-volume samples from many sources. The patented biosensor measures an enzyme in humans that is affected by nerve gases. Worden is now striving to make it applicable to a wider range of enzymes and extending it to antibodies, which are used in detecting diseases, toxins and microorganisms in food. Linking the biosensor system to antibodies is useful in food safety applications, including screening for therapeutic agents, measuring toxins and pathogens in food and environmental samples, point-of-care testing of biological samples and real-time on-site detection of chemical warfare agents.

► Worden and Satoh are working to develop prototypes of three commercial biosensor systems: portable point-of-care meters, electrochemical multiwell plates and flow-injection analyzers.

► MSU chemical engineering and materials science students will get innovation and technology-translation experience by participating in the research.

► Worden and Satoh will work with Conductive Technologies Inc. and MSU Technologies to commercialize the biosensor systems.

Delivering research-based processes to home kitchens

Consuming home-canned foods that have not been preserved properly increases the risk of foodborne illness or death. Outdated recipes and procedures result in unsafe canning techniques and increased risk of botulism. Surveys from the National Center for Home Food Preservation have reflected that many home food preservers use outdated and unsafe food preservation practices, most of which have been learned from family or friends.

Home food preservers in Michigan communities receive high-quality, research-based education using U.S. Department of Agriculture guidelines for safe food preservation. MSU Extension food preservation workshops teach Michigan residents how to safely handle and preserve food and use canning equipment. In 2014, more than 900 people participated in the workshop, either through face-to-face or online education.

A survey of participants reported:

► 98% will use correct processing times to preserve low- and high-acid foods safely.

► 97% will use correct processing methods to preserve low- and high-acid foods safely.

► 96% will follow research-based and tested recipes for home food preservation.

► 90% know how to properly use a pressure canner to preserve food.

Developing guidelines for ready-to-eat fruits and veggies

Overall, this project will serve to enhance the safety and quality of fresh-cut fruits and vegetables and reduce the number of produce-related outbreaks by:

- ▶ Identifying commercial slicing and dicing practices that increase risk for cross-contamination of fresh-cut produce, along with various mitigation strategies.
- ▶ Developing novel packaging strategies for minimizing pathogen growth and survival in the cold chain.
- ▶ Reducing risk of foodborne illnesses from fresh-cut produce through training activities aimed at processors, retailers, food service workers and regulators.

Enhancing the safety and quality of ready-to-eat, fresh-cut produce through integrated research, outreach and training targeted at the processing, packaging and retail distribution segments of the produce chain continues to be a top priority.

Elliot T. Ryser, MSU professor of food science and human nutrition, is leading a multi-disciplinary team with expertise from MSU, California Polytechnic State University, Rutgers University, Ohio State University and the International Food Protection Training Institute in Battle Creek, Michigan, to address fruit and vegetable contaminants such as salmonella and listeria. This multi-disciplinary, multi-institutional, multi-functional proposal addresses five distinct modules: the safety and quality of fresh-cut produce, processing, packaging and distribution, risk and economics, and education and training that have been integrated to ensure a successful outcome.



Photo: ©iStock.com/jeep5d



Photo: ©iStock.com/Margarya Vakhireva

Energy Production & Conservation

Re-envisioning agricultural landscapes to optimize ecosystem services

The United Nations projected that the global population will reach 9.6 billion by 2050. This anticipated increase of 2.4 billion people is already beginning to challenge the world's agricultural communities to provide adequate food, fuel and fiber while employing sustainable practices that conserve natural resources. The feat becomes more complex when coupled with the demand to grow more bioenergy crops, combat biodiversity declines and regenerate the habitat of agriculturally important insects.

Doug Landis, MSU professor of entomology, is exploring the role of perennial bioenergy crops in addressing these challenges and supplying a host of ecosystem services, a term which refers to the benefits organisms and ecological processes provide to humans. Examples include soil formation, nutrient cycling, water filtration, recreational opportunities, medicines, pollination and pest control.



Photo: MSU Communications & Brand Strategy

Landis, along with scientists from the Great Lakes Bioenergy Research Center, MSU AgBioResearch and MSU Extension, has:

- ▶ Determined that ecosystem services are enhanced when perennial bioenergy cropping systems are incorporated into agricultural landscapes.
- ▶ Explored efficient ways to construct agricultural landscapes so they provide the most benefit for the largest number of people.
- ▶ Worked to equip communities with tools that will help them make informed decisions about incorporating bioenergy crops into landscapes.

Empowering landowners interested in oil and gas leases

Following the workshops, participants reported:

- ▶ Lease bonuses increased by 68% or \$34.89 per acre, and royalties increased by 22.4% or \$12,600 per year.
- ▶ Post-production cost was reduced by 66% or \$49,599 per year.
- ▶ The average cropland acres per farm was 323 resulting in a one-time lease negotiation gain of \$11,263 per farm in bonus payments.

Since 2010, Michigan has seen a major increase in oil and gas companies contacting landowners offering to lease their mineral rights. A lease is a legal document that can last for many years. Landowners must know their rights and opportunities involving leases.

To assist landowners in this sometimes confusing process, MSU Extension has hosted 66 public meeting workshops that focus on oil and gas lease contracts, with total attendance of 7,643 since June 2015. The program helps owners understand lease contract terms and conditions, the rules and statutes that oil and gas companies must follow, and options to negotiate lease terms. It teaches owners specific contract changes to allow them to meet financial and land usage goals.



Showing farmers the benefits and savings of energy audits

- ▶ 100% of the farmers said they had a better understanding of the need for an energy audit.
- ▶ Five farmers indicated they intend to conduct an energy audit on their farms within the next three months, one said within the next six months, and three said within the next 12 months.
- ▶ An overwhelming majority of farmers indicated that their knowledge of funding opportunities through utilities, REAP and EQIP had increased.

MSU studies have shown, on average, a 46 percent reduction in energy expenses when energy audit-recommended energy conservation practices have been implemented. Power companies and the federal government are targeting farmers in an unprecedented way to entice them to implement energy conservation practices. Utilities offer substantial rebates and the federal government offers grants and low-interest loans to implement recommended energy conservation practices. An energy audit is the gateway for farmers to access rebates, grants and loans to implement audit-recommended energy conservation practices.

MSU Extension, Consumers Energy and DTE Energy sponsored a series of workshops during January 2015 at three different sites across Michigan, designed to help row crop, poultry, swine, livestock and dairy farmers learn how to use an energy audit to develop an energy management strategy.



Photo: ©iStock.com/Highwaystarz-Photography

Reducing MSU's campus carbon footprint

MSU takes seriously its role in reducing its carbon footprint and increasing sustainability, an issue of importance to many Michiganders. The T. B. Simon Power Plant at MSU burns coal, natural gas and biomass, which is then used to provide steam heat and electricity for the lecture halls, dorms and research labs. A partnership between the Great Lakes Bioenergy Research Center (GLBRC) and the power plant reduced the carbon footprint of the university by co-firing switchgrass, a renewable fuel, with coal.

MSU Extension bioenergy educators worked with the GLBRC and MSU in addition to harvesting and delivering the switchgrass to campus. In 2014, 416 tons of switchgrass were harvested from GLBRC fields and delivered to the power plant where it was burned to offset coal use and reduce the power plant's carbon footprint. This collaborative effort demonstrates the benefits of biomass combustion in helping to meet sustainable energy goals described in MSU's Energy Transition Plan.

- ▶ Switchgrass has 100 times less sulfur than coal resulting in lower sulfur oxide emissions.
- ▶ Switchgrass has five times less nitrogen than coal resulting in lower nitrogen oxide emissions.
- ▶ In the soil, switchgrass will sequester 179.9 grams of carbon dioxide per kilogram.

Family & Youth Development

Creating culturally competent children

In 2015, more than 5,900 youth in 28 counties participated in the China Art Exchange. Among surveyed program participants:

- ▶ 100% reported knowing and appreciating both their culture and the culture of others.
- ▶ 100% reported an increased awareness that there are similarities between themselves and Chinese children.
- ▶ 88% reported an increased respect for others who may be different from themselves.

Today's world is more interconnected than ever – colleagues, competitors or classmates on one side of the globe can join effortlessly with those a world away via the Internet or phone. This connectedness places a growing importance on the need for youth to have both an understanding of their place in the world and an appreciation for diverse cultures.

MSU Extension is helping youth develop these important skills by providing cultural competency enhancing experiences such as the Michigan 4-H China Art Exchange. Through this program, youth from China and Michigan create and exchange works of art that tell a story. These “visual letters” allow youth to communicate with each other despite language barriers. While developing the pieces, youth also take part in lessons about Chinese life and culture, enhancing the experience and their understanding about another culture.



Photo: ANR Communications

Providing caring adult role models for youth

Young people need caring adults in their lives who can provide guidance, listen to them, and support their goals and aspirations. While many youth find these individuals on their own, not all are so lucky. To help fill the void for those without a nurturing adult in their lives, MSU Extension offers formal youth mentoring programs in 10 Michigan counties.

Through these programs and the time committed by nearly 85 caring mentors, 270 Michigan youth were each matched with an encouraging adult who served as a personal coach, cheerleader and friend. These positive adult relationships help youth feel they have an ally in their corner – someone they can turn to for advice and support.

As a result of these MSU Extension mentoring programs:

- ▶ 97% of surveyed mentees felt they had mentors that cared about them and 90% said their mentors made them feel special.
- ▶ 79% of surveyed mentees felt their mentors helped them make better decisions and 64% talked to their mentors when they had a problem or concern.
- ▶ 60% of surveyed mentees were doing better in school, thanks to their mentors' help.

Ensuring the safety of Michigan's poultry industry

2015 marked the worst animal disease outbreak in history. By September, avian influenza had claimed the lives of more than 48 million birds, destroying the livelihood of numerous farmers throughout the Midwest. In a precautionary effort to protect Michigan's poultry industry from this same devastation, the Michigan Department of Agriculture and Rural Development (MDARD) took strong measures by cancelling all poultry shows and exhibitions in the state. The cancellation occurred just one week before the first of 83 local fairs began, impacting thousands of 4-H youth who traditionally show and sell poultry projects at these events.

Acting quickly, MSU Extension turned this negative situation into a positive learning opportunity by developing ways for 4-H'ers to demonstrate their knowledge and talent without live birds on site. Doing so ensured that the disease did not reach Michigan's domestic flocks and spread during fair season. Activities ranging from educational contests to showmanship with a life-like bird model provided options for county 4-H programs to showcase youths' work in the poultry area. In addition, MSU Extension worked alongside MDARD to create guidelines that allowed market bird projects to still be sold at local fairs.

With the assistance of these alternative activities, Michigan 4-H families quickly turned the unfortunate circumstances into useful learning experiences about animal health, biosecurity and risk management.



Photo: D'Ann Rohrer

As a result:

- ▶ Youth in nearly 95% of county 4-H programs were able to exhibit their poultry expertise at fair while minimizing the potential spread of avian influenza.
- ▶ More than 4,100 youth enrolled in the 4-H Bird Science area played a key role in ensuring the health and safety of Michigan's poultry industry.

Monitoring the presence of abuse in child custody exchanges

Based on a sampling of women monitored for a year, they determined:

- ▶ The majority of mothers reported emotional abuse, physical abuse or both during child exchanges, regardless of whether they were conducted in public or supervised by a nonprofessional.
- ▶ During unsupervised exchanges, mothers described numerous acts of mistreatment that occurred, from destruction of property to death threats and physical abuse.
- ▶ Child exchanges should have intervention (for example, third-party, professional supervision) when there's a history of domestic violence between parents.

According to Centers for Disease Control and Prevention data, nearly 5.3 million acts of violence occur against U.S. women 18 and older each year, resulting in approximately 2 million injuries and nearly 1,300 deaths. In most cases, these victims are harmed by an intimate partner.

Women in these situations are encouraged to cease contact with their abusers; however, this strategy is impossible to follow when child custody orders force women to interact with abusive former partners.

April M. Zeoli, MSU assistant professor of criminal justice, (photo left) has been examining child custody exchanges in which violence has occurred. Zeoli and her co-investigators assessed the efficacy of the strategies survivors and family courts employ to prevent continued abuse during child exchanges.



Photo: MSU AgBioResearch

Preparing youth for post-secondary education

As a result:

- ▶ 61% of 2014 Michigan 4-H seniors enrolled in post-secondary education, compared to 45% of their same-age peers.
- ▶ 4-H alumni are more likely to go to college than their same-age peers in 90% of Michigan counties.
- ▶ College enrollment rates of youth in 4-H pre-college programs is even higher, with 68% of 4-H Exploration Days, 71% of GLNRC and 78% of M4-HYCC seniors enrolling.

Studies show individuals with college degrees earn more over the course of their lifetimes and enjoy lower unemployment rates than those without post-secondary degrees. With more college graduates, Michigan benefits greatly – through higher taxable earnings, more disposable income and lower rates of unemployment – and produces a more skilled and educated workforce.

Helping to prepare the next generation of college graduates in Michigan is Michigan 4-H. Through its wide range of programs, Michigan 4-H promotes personal growth, career exploration and goal-setting. In addition, its designated pre-college programs – including 4-H Exploration Days, 4-H Great Lakes & Natural Resources Camp (GLNRC) and Michigan 4-H Youth Conservation Council (M4-HYCC) – prepare youth for post-secondary education by helping build important life skills, increase college aspirations and improve college readiness.

Preparing young Michiganders for success



Photo: ©iStock.com/Sasiistock

The success of Michigan's youngest generation is of utmost importance as they are the future of the Great Lakes state. Because the early childhood years are the building blocks for future success, the first people to influence a child – his or her parents and caregivers – play a critical role in the proper development and later academic achievement of Michigan's youth. Ensuring these children are ready for school – both socially and academically – will provide long-term benefits to individuals, communities and the state as a whole.

To help parents and caregivers achieve this important goal, MSU Extension provides a variety of early childhood education programs and resources. As a result, parents and caregivers are equipped with the tools and knowledge necessary to enhance children's school readiness and become their best resources and advocates.

In 2014, MSU Extension delivered 73 workshops and 31 educational series to more than 2,100 participants.

- ▶ 92% learned techniques to help young children learn and promote school readiness.
- ▶ 88% learned ways to promote healthy lifestyle opportunities for children.
- ▶ 87% increased their knowledge of child development.
- ▶ 83% increased their knowledge of how to keep children physically, emotionally and socially safe.

Building STEM careers and positive life outcomes

With a growing number of jobs in the fields of science, technology, engineering and mathematics (STEM), Michigan's youth must be prepared for careers in these promising areas. Equally as important, youth must develop the creative prowess and critical thinking skills that will allow them to address future issues with ingenuity and determination.

To help youth develop these critical skills and an affinity for the STEM fields, MSU Extension's 4-H Tech Wizards program matches youth with a caring adult role model who explores the exciting world of STEM alongside them. Whether building a robot or producing a video, youth develop important life skills and an interest in STEM, all while experiencing the positive developmental outcomes of mentoring. In the past year, Michigan 4-H Tech Wizards served 200 youth and expanded programming to five new counties – doubling the number of youth and communities served by the successful program.



Photo: ANR Communications

After being matched with a mentor, surveyed program youth reported:

- ▶ 100% plan to attend college, compared to just 83% before the mentoring experience.
- ▶ 75% feel they have the “best possible life,” compared to just 62 percent before the mentoring experience.

Health & Wellness

Improving nutrition and physical activity in Michigan

Participants reported the following changes:

- ▶ 93% of teachers reported that their students demonstrated an increased awareness of the importance of good nutrition.
- ▶ 75% of adult participants showed improvement in one or more nutrition practices, such as making healthy food choices, planning meals in advance and reading food labels.
- ▶ 50% of adults adopted healthy eating habits by increasing their daily vegetable consumption.
- ▶ 42% of adults adopted healthy eating habits by increasing their daily fruits consumption.
- ▶ 32% of adults improved their weekly strengthening and stretching activities.

Limited income and poor nutrition affect a person's quality of life and can increase healthcare costs. Michigan has the 10th highest obesity rate in the U.S. Of those enrolled in state food assistance programs, about two-thirds of adults and youth are overweight or obese, with more than 30 percent of youth considered obese.



Nutrition education programs teach necessary skills to buy and prepare nutritious foods on a budget, and ways to increase daily physical activity. MSU Extension delivers affordable, evidence-based education to serve the needs of adults, youth and families in urban and rural communities. MSU Extension nutrition education programs reached over 84,000 Michigan adults and youth in 2014.



Connecting health research and communities

A 2014 report, *Cooperative Extension's National Framework for Health and Wellness*, identified the need for Extension to create partnerships and secure adequate resources to respond to Americans' health conditions and health disparities in communities throughout the country.

The MSU College of Human Medicine's six state-wide community campuses offer access to diverse populations and support research and medical education in a variety of clinical settings. MSU Extension has a 100-year history of community connections and expertise in addressing health-related issues through direct education to diverse audiences. Together, the College of Human Medicine and MSU Extension formed the Extension Health Research team. This group is tasked to identify community needs and to support research to improve health outcomes of Michigan residents.

Their vision is to:

- ▶ Engage communities in the university's clinical and translational health research by offering health education resources locally.
- ▶ Understand and prioritize community health needs, educate audiences, train leaders and help form connections between the community and health care education professionals.
- ▶ Improve the health of vulnerable populations and the variety of health care challenges they face through enhanced communication with quality primary care practices.

Delivering culturally relevant nutrition education

Language and cultural barriers must be overcome to deliver effective nutrition education to Michigan's diverse communities. Hispanics represent more than 4 percent of Michigan's population, and in 2011, more than 26 percent of Michigan Hispanic households experienced food insecurity as compared to the U.S. average of 14.5 percent. Michigan is home to more than 1 million residents who are deaf or hard of hearing, with the majority living in Wayne and Oakland counties. Deaf adults are more likely to be obese because of lack of knowledge of health care and available preventative medicine interventions. Additionally, Michigan has the nation's second-highest Arab population, and a recent study found that more than 56 percent of Arab Americans age 30 and older were considered overweight.

MSU Extension is investing efforts to break these cultural barriers, delivering nutrition education to 8,500 underserved and vulnerable communities.



Efforts include:

- ▶ Hosting culturally appropriate nutrition and physical activity education events for seasonal and migrant workers at migrant Head Start centers during summer 2015.
- ▶ Adapting the *Eating Right Is Basic* cookbook to be culturally relevant to the Arabic community.
- ▶ Transitioning the Eat Healthy, Be Active program to be available virtually for people who are deaf or hard of hearing.

Understanding West Nile virus in urban populations

Using West Nile virus (WNV) as the model infection, Walker and his co-investigators:

- ▶ Identified the factors that encourage WNV-infected mosquitos to set up among human populations.
- ▶ Determined that the highest areas of infection occur in post-World War II neighborhoods – communities nestled between inner cities and newer suburbs.
- ▶ Found that spikes in infection correlate with increases in temperature and decreases in precipitation events.

Of the major events of 2014, few earned the media coverage of the Ebola breakouts in Guinea, Sierra Leone and Liberia. While the media followed the virus' movement throughout the world, the Centers for Disease Control and Prevention quietly reported on other infectious diseases also affecting people around the world.

Polio, avian influenza, Middle East respiratory syndrome coronavirus, Chikungunya and enteroviruses caused thousands to become ill. These infectious diseases and several others challenged health infrastructures, chipped away at public health budgets and claimed lives all over the world.

Edward "Ned" Walker, MSU professor of microbiology and molecular genetics, is examining how emerging infections behave in time and space. He will use this information to further basic biology and to develop predictive models that guide community and public health responses to emerging diseases.



Photo: MSU Communications & Brand Strategy

Fighting diabetic vision loss

- ▶ Nearly 350 million people live with diabetes around the world.
- ▶ The National Eye Institute expects cases of diabetic retinopathy to double by 2050.
- ▶ Diabetic retinopathy costs the nation approximately \$500 million annually.



Photo: MSU AgBioResearch

The World Health Organization estimates that approximately 29 percent of diabetes patients over the age of 40 will develop diabetic retinopathy, or vision loss, as a result of the condition. Currently, no cure exists for this complication, but MSU physiologist Julia Busik wants to reverse that.

Busik's lab is working to build an understanding of the mechanisms that drive diabetic vision loss. She has linked the condition to two others: dyslipidemia, an abnormal concentration of fatty compounds in the blood that causes retinal damage; and reduced performance of circulating angiogenic cells (CAC), which repair damage to retinal tissue. By discovering ways to restore both the concentration of fatty compounds and CACs to normal levels, new treatments will allow patients to sustain their vision longer and will ultimately eliminate diabetic retinopathy entirely.

Reducing the risk of zoonotic disease transmission

Infectious disease outbreaks are a concern for many Michiganders, as well as people across the globe. Dependent on if the outbreak is in wildlife, animal industry or human populations, it can have devastating consequences for the biosystem, food supply or human health. When the disease is zoonotic – transmissible between humans and animals – the outcomes can be catastrophic in more than one sphere.

To help youth understand the risk of zoonotic disease transmission and learn what precautions can be taken to minimize the danger, MSU Extension Michigan 4-H partnered with the Michigan Department of Agriculture and Rural Development and the Michigan Department of Health and Human Services. This partnership resulted in the development of resources that have been used across the state to improve youth awareness and understanding of zoonotic diseases.



Photo: ANR Communications

As a result:

- ▶ More than 61,000 copies of the Michigan 4-H zoonotic disease curriculum were distributed to 4-H members across the state.
- ▶ 2,000 zoonotic disease education toolkits and lessons were disseminated to Michigan 4-H clubs with 92% of surveyed youth indicating they would adapt behaviors to prevent zoonotic disease transmission.
- ▶ More than 400 signs promoting animal and human health were distributed to Michigan fairs and festivals to build awareness.

Training researchers to assess dangerous microbes



Photo: MSU Communications & Brand Strategy

Even as the global population surpasses 7 billion, humans are vastly outnumbered by the trillions of microorganisms on the planet. Many are essential for everyday life, but large numbers of these invisible creatures present significant health risks. MSU scientist Jade Mitchell has coordinated a quantitative microbial risk assessment (QMRA) program to train fellow scientists to assess microbial risks and to assemble plans to help keep people safe.

QMRA is a four-step process used to characterize the human health risk associated with exposure to various microorganisms. The information assesses the danger posed by pathogens and to develop appropriate plans in case of public exposure to infectious agents in all types of settings. Mitchell's program focuses on helping quantitative scientists and engineers connect with biologists and social scientists in order to draw on the knowledge created by specialists from a range of disciplines. Participants in the program will learn the essentials of QMRA practice and apply their knowledge in real-world case studies.

- ▶ This program is funded through a nearly \$1 million grant from the National Institutes of Health.
- ▶ QMRA training aids the development of engineering systems for One Health, a national initiative that tracks the health of people, animals and the environment.

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