

Michigan State University

AgBioResearch

MICHIGAN STATE
UNIVERSITY

Extension



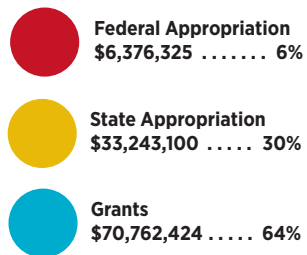
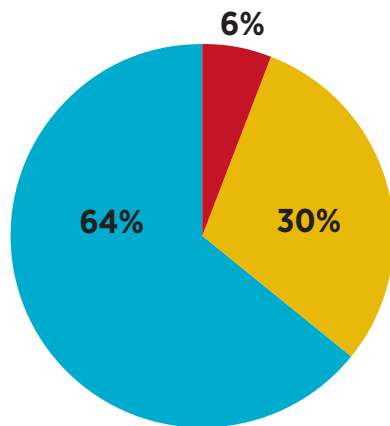
LEGISLATIVE REPORT 2011-12

FUNDING

Michigan State University

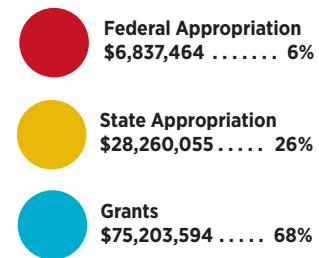
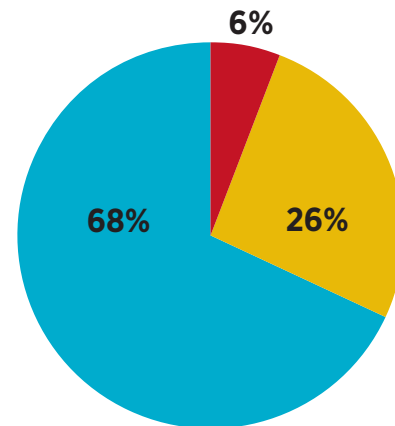
AgBioResearch

FUNDING FISCAL YEAR 2010-2011



TOTAL: \$110,381,849

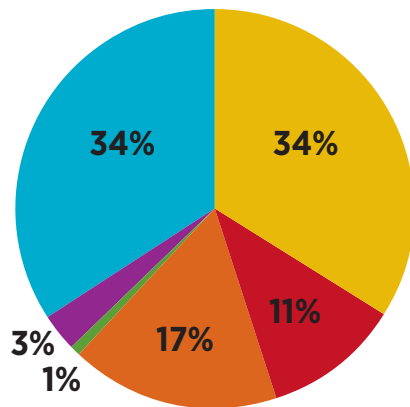
FUNDING FISCAL YEAR 2011-2012









TOTAL: \$110,301,113

MICHIGAN STATE UNIVERSITY | Extension

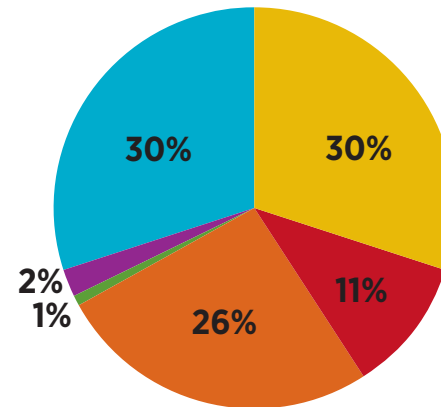
FUNDING FISCAL YEAR 2010-2011









 State Appropriations \$28,672,600 34%	 MSU General Fund \$853,503 1%
 Federal Cooperative Extension \$9,162,144 11%	 Federal Special Projects \$2,452,350 3%
 County Investments \$14,678,070 17%	 Grants \$28,621,806 34%

TOTAL: \$84,440,473

FUNDING FISCAL YEAR 2011-2012



 State Appropriations \$24,365,745 30%	 MSU General Fund \$939,213 1%
 Federal Cooperative Extension \$9,224,802 11%	 Federal Special Projects \$1,926,403 2%
 County Investments \$21,326,708 26%	 Grants \$25,083,689 30%

TOTAL: \$74,866,560

INTRODUCTION FROM THE DIRECTORS

Michigan State University

AgBioResearch



Steve Pueppke
Director, MSU AgBioResearch

These continue to be fiscally challenging times. We've worked diligently to adjust our expenditures to be in line with the reduced state appropriation and have been successful in doing this in ways that are more efficient, while strengthening our priority research and Extension programs in food and agriculture production, nutrition and food safety, community and natural resources development, youth development and renewable energy.

It's more important than ever to make sure our offerings match closely with our clients' needs. That's why, with constant and consistent input from our stakeholders, we've refocused MSU Extension programming to ensure that we're giving Michigan residents what they need: meaningful access to the latest life-changing scientific research.

We have also had great success with external funding. The past year has seen our scientists and educators land significant grants from the U.S. Department of Agriculture, the National Science Foundation, the National Institutes of Health, the U.S. Department of Energy and others. This wouldn't be possible without the critical state and federal appropriations that we receive to leverage these funds and help us attract and retain the caliber of scientists and Extension educators needed to advance this important work.

There are collateral benefits to this research as well. We are training young scientists, stimulating economic activity, and drawing a positive media spotlight on our state. It's all a part of AgBioResearch and MSU Extension missions.

The stories in this report are a testament to the continued excellence in our research and outreach programming that our stakeholders and Michigan's residents have come to expect.

A handwritten signature in black ink, appearing to read "Steve Pueppke".

Steve Pueppke
Director, MSU AgBioResearch

A handwritten signature in black ink, appearing to read "Thomas G. Coon".

Thomas G. Coon
Director, MSU Extension

MICHIGAN STATE UNIVERSITY | Extension



Thomas G. Coon
Director, MSU Extension

PEST-RESISTANT SOYBEANS GROW OUT OF MSU LAB

Soybean growers are about to turn the tables on one of the most destructive pests of their crops, thanks to MSU associate professor Dechun Wang. After testing more than 2,000 strains of soybeans, Wang developed a germplasm, known as “Sparta – the soybean aphid shield,” to breed into soybean varieties suited to Michigan’s growing season. Soybean aphids suck plant sap and secrete sticky honeydew that promotes the growth of sooty black mold, and, when they sprout wings, they can transmit plant viruses widely. It takes aphids just five days to produce more babies, and aphids are born pregnant, so the regeneration cycle is incredibly fast. Unchecked, aphids can lay waste to half the output of a field, but one application of insecticide might add 10 percent to the cost of production – and kill beneficial insects as well. Wang’s germplasm already is the subject of growing interest among seed companies. With one exception, all the major soybean genetics companies have licensed this germplasm because of its high level of resistance to soybean aphids. The ultimate goal is to develop one variety that has all the resistant genes, maximizing protection against various biotypes of aphids and perhaps other pests such as Japanese beetle.

ENVIRO-WEATHER HELPS MICHIGAN FARMERS PROTECT CROPS, MAXIMIZE PRODUCTION

MSU Extension is committed to helping grow Michigan’s economy, and agriculture is one of the state’s biggest economic drivers. To help educate agricultural producers to protect their crops and boost their yields while protecting the environment, MSU Extension created Enviro-weather, a comprehensive network of weather stations strategically located throughout Michigan’s crop-producing regions. Weather information is collected, processed and archived, providing a web-based database to help Michigan farmers predict weather events and pest outbreaks so they can better manage their crops. Data is shared with groups such as the National Weather Service and used in more than a dozen college and university classes to teach students about weather, agriculture, integrated pest management and ways to use weather information to make risk management decisions. In 2011, six weather stations were installed in Wisconsin, bringing the total number of stations to 70. A redesigned website was launched, as was a new anthracnose disease prediction model for blueberries and the system’s first premium subscription service, a frost alarm.

According to a survey of Michigan fruit growers in 2011, the economic impact associated with using Enviro-weather-based information on the Michigan tree fruit industry alone was estimated at \$1.8 million, and respondents reported a more than 5 percent increase in both crop yield and quality.





FOCUSING ON THE CALF TO MANAGE JOHNE'S DISEASE

About 8 percent of the beef herds and 68 percent of the dairy herds in the United States have at least one animal infected with *Mycobacterium avium* ssp. *paratuberculosis* (MAP) – the bacterium that causes Johne's disease. This is a contagious, untreatable and fatal gastrointestinal disease. The slow, progressive nature of Johne's disease makes diagnosing animals challenging. Though infection typically occurs in calves, animals generally don't express clinical signs of Johne's disease until later in life. MSU professor Dan Grooms, led a nearly decade-long project called the Michigan Johne's Disease Control Demonstration Project. The objective was to identify which management practices are the most effective at controlling the spread of Johne's disease. The bottom line: focus on the calf. When the risk to calves being exposed to MAP is reduced, the impact of the disease also is reduced. Findings from this work will increase profitability and improve animal welfare in the beef and dairy industries.

THOUSANDS ENJOY BREAKFAST ON THE FARM

To bridge the gap between consumers and farmers, MSU Extension educators created Breakfast on the Farm (BOTF) to give non-farm families and community members an opportunity to tour local farms and learn about modern food production. In counties across the state, thousands of consumers have seized the opportunity to spend time outdoors with their children while learning about where their food comes from. Since 2009, 22,500 people have visited 13 farms throughout Michigan to learn how farmers care for the environment and their animals and produce a safe, wholesome food supply. BOTF has grown in popularity each year. In its first year, each BOTF drew about 1,000 visitors; in 2012, each event drew an average of more than 2,500 visitors. Agricultural literacy is of the utmost importance to Extension educators at MSU, and BOTF has been a huge success in increasing MSU Extension's educational reach. Making the events possible are hundreds of volunteers, numerous sponsors and countless hours of planning. Michigan's food and agricultural system contributes \$91.4 billion to the state's economy, and Extension programs such as BOTF continue to support farmers and the state by educating consumers about agriculture.

HELPING TO BOOST CROP YIELDS, REDUCE PESTICIDE USE AND PRESERVE WATER QUALITY

MSU Extension protects Michigan's water resources and preserves quality of life for residents by working with farmers to prevent water contamination without compromising crop yields or quality.

Extension worked with farmers to reduce pesticide use, increase cover crop use (which reduces erosion) and protect water quality in 2010-11. A total of 1,202 growers and homeowners responded to a survey and results indicated:

- » 937,830 fewer pounds of Nitrogen (N) applied over 87,821 acres.
- » 44,871 fewer pounds of Phosphorus (P2O5) applied over 4,912 acres.
- » A 402,155-pound reduction in active pesticide ingredients applied over 403,498 acres.
- » A 39,626-pound reduction in broad-spectrum pesticides used on 15,055 acres in favor of new, narrow-spectrum chemistries that limit the impact on non-target organisms.

Changes in cover crop seed sales indicate that use of cover crops has increased by an estimated 202,209 acres over the past year. Predictive models estimate that the increase in cover crop use corresponds to:

- » 506,817 fewer tons of soil sediment loss.

- » 26,530 fewer pounds of Nitrogen moved.
- » 136,575 fewer pounds of Phosphorus making its way to surface waters.

By working with growers and homeowners, MSU Extension has been able to report a total water use savings of 5,910,000 gallons on 4,876 acres. As a result of MSU Extension efforts, farmers are saving on pesticides and being environmentally responsible while maintaining crop yield, and consumers are benefitting from cleaner water.





PLANT GENETIC RESEARCH LEADS TO PROGRESS IN FIGHT AGAINST COSTLY CHERRY DISEASE

Cherry leaf spot is the most costly disease facing the Michigan tart cherry industry (valued at \$42.7 million per year). Caused by a fungus that thrives and spreads quickly in humid conditions, the disease attacks foliage, causing leaves to yellow and fall from the tree. Repeated premature defoliation severely weakens the tree and can eventually lead to death if winter conditions are severe. Although fungicides are the primary means of controlling the disease, MSU professor Amy Iezzoni is determined to develop a genetic solution. In her studies, she and doctoral student Travis Stegmeier have identified a chromosome region in cherry that contains a gene that controls resistance to cherry leaf spot. It is found in a wild cherry known as *Prunus canescens*, which produces pea-sized fruit – much too small to market. *Prunus canescens* is able to “recognize” the cherry leaf spot fungus and destroys it, preventing defoliation of the tree. Iezzoni has been breeding the *Prunus canescens* with Montmorency – the major tart cherry variety grown in Michigan – and has successfully transferred the resistance through three generations so far. Ultimately, Iezzoni hopes to develop a new cultivar that is resistant to cherry leaf spot and produces highly marketable fruit.

MEAT LABORATORY AN OPPORTUNITY FOR RESEARCH AND OUTREACH

As the demand for locally produced foods continues to increase, research and outreach from MSU’s Meat Laboratory is assisting in the race to develop new products. Locally produced meat is gaining in popularity and farmers want to meet this demand by selling directly to consumers. Consumers want their food to be grown locally but that doesn’t diminish the importance of convenience, safety and satisfaction. The Meat Laboratory is conducting research on better microbial safety to reduce food-borne illness (related to Salmonella), as well as consumer safety issues. Research is also under way on improving protein functionality, processing technology and exploring additives/processing techniques for under-utilized fish species. The laboratory doesn’t just serve as a research facility but also is a great opportunity for outreach and education. More than 200 youth attended meat science events related to FFA and 4-H, more than 70 consumers attended workshops on meat production and food safety, and small meat processors have attended seminars and trainings on new production technologies, state regulations and stunning methods. MSU students also gain valuable experience that helps them land employment in the meat and livestock industries.

CONFERENCES ATTRACT INDUSTRY LEADERS

Throughout the year, MSU Extension hosts educational events for farmers, agribusiness professionals and regulators to ensure they have the information needed to make sound, science-based management decisions.

During the past year, MSU Extension hosted educational events on topics ranging from pest management to more efficient water use. For example:

» **MSU Integrated Pest Management (IPM) Academy, Winter 2012.**

MSU Extension educators developed a new program to help IPM users adopt management practices that increase crop efficiency and reduce unnecessary pesticide use. Participants reported they planned to implement concepts learned – such as scouting for insects and diseases, using weather modeling, using pesticides with low biological impact, and supporting beneficial insects and native pollinators – all of which will directly affect nearly 60,000 acres of agricultural land in Michigan through increased disease and insect monitoring and more efficient pesticide use.

» **4th Annual Symposium on Managing Animal Mortality and Health Risk, May 2012.**

In the event of a mass animal mortality event, unified efforts are necessary to

ensure that animal carcasses are dealt with properly and to prevent the spread of disease. During Michigan-hosted educational sessions and tours, MSU Extension experts shared information with researchers, producers, policymakers and regulators on carcass disposal, technology, planning and policy. The symposium helped attendees learn to effectively manage mass mortality events, animal disease outbreaks and food contamination events.

» **Climate, Water and Agriculture webinars, Spring 2012.**

Climate variability and change, combined with increased water use to meet the needs of Michigan residents, industry and agriculture, could alter water resource allocation and pose challenges to the production of food, fiber and fuel. A series of webinars, hosted by MSU Extension, the USDA Natural Resources Conservation Service and the Michigan Department of Environmental Quality, discussed the important role that water plays in modern agricultural production with an audience of farmers, agriculture professionals, state and national agency personnel, and stakeholders. At the completion of the five sessions, nearly 75 percent of the participants found the information presented to be “useful” or “very useful.”



MORE WINE GRAPE VARIETIES SOUGHT AS NUMBER OF MICHIGAN WINERIES EXPLODE

Michigan wine grape production has been steadily rising, in large part because of an increase in the number of wineries across the state. Michigan has more than 90 wineries today, compared with 50 six years ago. To meet increased demand for local wines, Michigan growers are planting more wine grapes. One project, under the direction of MSU assistant professor and viticulturist Paolo Sabbatini, aims to boost the Michigan red wine sector in particular. It is called the National NE 1020 – Coordinated Wine Grape Variety Evaluations in the Eastern USA. The study strives to identify current and emerging grape varieties best suited for specific geographic regions. As part of the trial, Sabbatini has planted wine grape varieties at two MSU AgBioResearch centers – 32 varieties at the Northwest Michigan Horticultural Research Center in Traverse City and 25 varieties at the Southwest Michigan Research and Extension Center in Benton Harbor. Twenty wines made from the experimental grapes were showcased as part of a recent wine-tasting workshop. Three reds – Zweigelt, Teroldego and Lagrein – earned considerable praise.

HELPING GROWERS MANAGE A NEW PEST

Michigan farmers are dealing with a new pest that has the potential to create significant economic losses to the state's fruit crops. Spotted wing drosophila (SWD), an exotic vinegar fly of East Asian origin, was first found in southwestern Michigan in late fall 2010. In the western United States, it had already infested numerous fruit crops. Unlike the native vinegar fly, which is more of an annoyance than a problem, SWD (*Drosophila Suzuki*), is able to lay eggs in ripe fruit still on the plant rather than in overripe or rotting fruit. Populations of SWD can build quickly because there can be multiple generations per year, and female flies (which live 20 to 30 days) can lay hundreds of eggs during their life spans. Michigan growers are prepared for this new pest because of the actions of the SWD Response Team, headed by MSU professor Rufus Isaacs. Once SWD was found, the team put out the word through a newly created website, informational materials and presentations at grower meetings. Though this pest has great potential to create economic losses, being forewarned means that Michigan fruit growers are more prepared to deal with it.

GETTING TO THE ROOT OF SOIL-BORNE DISEASES

Ninety percent of the 2,000 major diseases of principal U.S. crops are caused by soil-borne plant pathogens. They result in losses to farmers estimated at \$4 billion a year. There currently are few effective and economical post-planting strategies for disease control. A research team, led by MSU assistant professor Jianjun “Jay” Hao, is working on ways to manage plant-microbe interactions in soil that will benefit both organic and conventional farmers. Researchers have successfully characterized the soil that suppresses potato common scab and established a program for fundamental soil-borne disease study. The researchers also discovered innovative biological agents for disease control. One of the bacterial strains, *Bacillus amyloliquefaciens* (BAC03), shows strong antimicrobial activity against several important soil-borne pathogens. Managing, not controlling, plant diseases involves both ecology and microbiology because pathogens are part of the ecosystem. By using both, researchers hope to manipulate pathogens for less impact on production without much chemical input to the soil, thereby supporting healthier agricultural production.

FRUIT INDUSTRIES PUTTING POSITIVE ‘FOOTPRINTS’ ON ECOLOGY

The production of Michigan-grown apples and cherries is not only contributing to the healthfulness of society, it’s also providing a boost to the environment. The trees pull carbon, an essential component of heat-trapping gases such as carbon dioxide, from the atmosphere and store it in their tissue. This amounts to a positive carbon footprint, according to a new study from MSU professor James Flore. His research has shown that both apple and cherry trees absorb slightly more carbon from the atmosphere than is emitted in the form of greenhouse gases during crop production activities. Flore based his findings on a formula established by the Chicago Climate Exchange. Although the possibility of growers selling credits on the carbon exchanges was one of the main reasons prompting the study, Flore said the industry could also achieve public relations benefits by promoting the positive carbon balance and demonstrating a concern about greenhouse gas emissions. Growers can now calculate their own orchard’s carbon footprint by plugging into the formula such factors as acreage, number of trees and tree size.



SOLVING THE INFERTILITY PUZZLE IN DAIRY COWS

Heifers have a 70 percent conception rate; the average conception rate for lactating dairy cows is 30 to 35 percent. To produce milk, dairy cows must give birth to a calf every 12 to 14 months. So, one of the highest priorities for the dairy industry is figuring out how best to help producers get cows pregnant. To help address this challenge, AgBioResearch animal scientist George Smith is studying the egg at the cellular level. There is a growing body of evidence that the problems with egg quality contribute to poor reproductive performance in dairy cattle. What Smith wants to learn is what makes a good egg good and a bad egg bad, how to tell the difference, and what factors have to be optimal to produce healthy, viable offspring. Not only will advances in reproductive technologies help producers achieve higher conception rates in traditional commercial herds, but the findings may enhance success rates in bovine embryo transfer and in vitro fertilization. The work also may translate long term into a better understanding of infertility problems in humans.

INCREASING DAIRY PRODUCTION EFFICIENCY

As human populations increase and available arable land decreases, agricultural systems are under pressure to produce more food more efficiently. MSU professor Mike VandeHaar believes that breeding dairy cows that produce milk with less feed can help meet this goal. The research focuses on ways to increase the efficiency and sustainability of milk production by discovering why some cows are genetically predisposed to produce more than 100 pounds of milk a day with less feed. The project includes developing a feed efficiency database of 8,000 genomically characterized Holstein cows, determining the genetic architecture of feed efficiency and building a foundation for genomic selection of more efficient animals. In addition, researchers are developing and implementing genomic breeding tools to produce cows with enhanced feed efficiency and implementing support tools to improve whole-herd feed efficiency. These advances will ultimately help feed the estimated 9 billion people who will inhabit the planet in the next 40 years. The researchers are using a \$5 million grant from the U.S. Department of Agriculture's National Institute of Food and Agriculture for the project.



COMMUNITY & ECONOMIC DEVELOPMENT

CREATING A THRIVING MARKET FOR TOURISM

Michigan's \$18 billion-a-year tourism industry is one of the state's largest. A five-year strategic plan to guide tourism activities is being developed to ensure its continued success. The effort is being led by MSU associate professor Sarah Nicholls, who specializes in tourism planning and development, in collaboration with the state's official tourism promotion agency, Travel Michigan, and the governor-appointed Travel Commission. The plan, which includes a vision statement for the industry, identifies specific goals with detailed objectives and strategies on what is needed and how the industry will move toward its vision over the next five years. In particular, the plan will contain specifics on implementing and evaluating progress. The new plan used information from the evaluation of the 2007-2011 strategic plan. Nicholls has already received input from more than 100 attendees at the Pure Michigan Governors Conference on Tourism, held in March, and information and suggestions from more than 250 citizens and industry members collected during a series of 12 stakeholder meetings held around the state this summer. Interested groups will have opportunities to review the objectives and strategies and look at a draft of the plan before its completion in December.

PAVING THE WAY FOR SAFE ROUTES TO SCHOOL

Communities in Michigan and across the United States are creating routes for children to walk safely to school. Michigan's Safe Routes to School program started in 2003 and is managed by the Michigan Department of Transportation. A federal program was authorized in 2005. Parents, school officials and other members of a community evaluate the unique needs of their community. The program may include putting in new sidewalks or repairing old sidewalks, slowing down traffic near crossings, using crossing guards, adding signage, installing bike racks, teaching children about pedestrian safety, and educating parents about the benefits of walking or biking to school. MSU professor Christine Vogt is an evaluator for the Safe Routes to School program and is collecting data from students, parents and school officials across Michigan on attitudes about walking or biking, beliefs about barriers to doing so, the methods of transportation that people use and would like to use. The data will be used to help Congress consider a renewal of the program's funding.



CHARTING A PATH TO GOOD FOOD IN MICHIGAN

Nearly six out of 10 Michigan residents lack adequate access to the food necessary for a healthy daily diet, according to the Michigan Department of Agriculture and Rural Development. Ironically, Michigan is the second most diverse agricultural state in the nation. This disparity is addressed in the first-of-its-kind document titled the “Michigan Good Food Charter” (www.MichiganFood.org). Mike Hamm, MSU professor and C.S. Mott professor of sustainable agriculture, was instrumental in developing the charter, which emphasizes

the need within Michigan to grow, sell and eat more “good food.” “Good food” is defined as healthy, green, fair and affordable. An important tool to improving the abundance of and access to good food is the establishment of food hubs in Michigan. Food hubs facilitate the aggregation, storage, processing, distribution and marketing of local and regional food. As the number of midsized farms continues to decrease, the smaller farms that remain will increasingly rely on established food hub infrastructure to sell their products for maximum value. The new Center for Regional Food Systems (CRFS), formerly the C.S. Mott Group, is laying the foundation for a statewide food hub resource network in Michigan, and MSU Extension is serving as a key partner. Rich Pirog, who has an Extension appointment and is leading the CRFS, is also a member of the National Good Food Network Food Hub Collaboration, the largest national food hub organization in the United States. This relationship will help Michigan be at the forefront of the food hub movement. MSU Extension has connected with emerging or existing food hubs in every region of Michigan, including the Eastern Upper Peninsula Food Hub Initiative, the Grand Traverse Regional Market Initiative, both the Fulton Street Farmers Market and the Downtown Market in Grand Rapids, the Flint Food Hub, the Macomb Food Systems Council and Eastern Market in Detroit.



SEA GRANT HELPS WHITEFISH PROCESSORS TURN BYPRODUCT EXPENSE INTO PROFITS

In the Great Lakes, commercial whitefish producers struggle to stay in business because of limited opportunities to expand their harvest and low dockside prices for fish. Producers are also required to dispose of their fish waste properly, creating an additional economic burden on their business. Michigan Sea Grant began working with fish producers and processors to develop new strategies for managing fish waste. Sea Grant organized a workshop on fish waste composting and repurposing unused parts of the fish, and developed a protocol for handling and selling unused fish byproducts for use in other food products. This strategy helps some Michigan fish producers now realize an income – rather than an expense – in responsibly repurposed fish wastes. Some Michigan whitefish producers are now selling fish frames, pin bone meat and small fish for use in other food products, as well as fish heads for lobster bait. A large seafood processing company covers transportation costs and pays per pound/per truckload, allowing Michigan fishers to make a profit from waste they had previously been paying to store and landfill.

MSU PRODUCT CENTER CHARTS FOOD AND AGRICULTURE'S \$91.4B ECONOMIC IMPACT

The MSU Product Center provides coordinated, universitywide assistance to help Michigan entrepreneurs develop and commercialize high-value, consumer-responsive products and businesses in the agriculture, food, natural resources and bioeconomy sectors. Understanding the value of food and agriculture to Michigan's economy is key to that process. In April 2012, MSU Product Center researchers released "The Economic Impact of Michigan's Food and Agriculture System." The updated study shows that the industry contributes an estimated \$91.4 billion to Michigan's economy. That's an increase of nearly 50 percent between 2004 and 2010. Though the largest dollar growth came from the wholesale and retail distribution portion of the supply chain, the largest percentage of growth came from farming.

The farming line encompasses food, energy and horticultural crops, as well as animal production and turf production. The impact of Michigan's farms and the commodities they produce is 12 percent of the overall total, and their economic contribution has nearly doubled – from less than \$7 billion to more than \$13 billion. It would be difficult to find another business sector that has pulled through the recession with those kinds of numbers in just six years. According to the report, Michigan has more than 73,000 full-time farmers and farm workers. That's 12 percent of the 618,000 direct jobs in Michigan's food and agriculture business sector. Food and agriculture account for 22 percent of all jobs in Michigan when direct, indirect and induced jobs are considered.



EDUCATING THE COMMUNITY ON IMPORTANT FISCAL ISSUES

Michigan officials have spent more than a decade dealing with difficult fiscal issues, a problem only exacerbated by the recent worldwide recession. MSU Extension was able to leverage its expertise and statewide reach to help as communities looked to negotiate tough financial issues while also

maintaining vital services. MSU professor and David Morris Chair Mark Skidmore, along with a group of MSU Extension educators, joined forces with the Michigan Treasury Department to build an online resource called the F-65 Database that could be used to report and retrieve financial information for all 1,856 cities, villages, townships and counties in Michigan. This resource allows anyone to see and compare revenues, expenditures and other financial information. The F-65 Database will also serve as the means by which communities will publicly report key financial, public safety and other data online, which will enable those communities to access state dollars. MSU Extension also worked with state government officials and other partners on a series of conferences and one-on-one sessions that attracted more than 500 of Michigan's school, political and other community leaders for updates on the latest laws, including Public Act 4, and how to navigate fiscal challenges. Extension also created policy papers that examine the fiscal health of the city of Flint and the greater Lansing area, as well as a series of frequently asked questions guides to help residents understand the complicated issues involved in the Detroit Consent Agreement.

PROPER FOOD PRESERVATION SAVES LIVES AND MONEY

A national consumer survey on knowledge and practice of home canning techniques found that some home food processors use practices that put people at high risk for food-borne illness and economic losses due to food spoilage. Common mistakes include creating their own canning recipes, not venting a pressure canner, rushing a pressure canner cool-down process and retightening screw bands while jars are still hot. Many people also add extra vegetables to salsa to increase the vegetable content, but they are actually diluting the acidity, which can result in deadly diseases such as botulism. In 2011, more than 1,160 individuals from 45 counties attended food preservation workshops or training series, where they learned how to store food safely by canning, preserving or dehydrating. Nearly 300 adults in 13 counties also attended the MSU Extension ServSafe training, a national certification program primarily for restaurant managers and workers. They become certified and are able to disseminate information on safe practices in their establishments. MSU Extension has also released DVDs such as “Preserving Homegrown Fruits and Vegetables Safely,” “Intro to Food Preservation,” “Water Bath Canning Basics,” “Pressure Canning Basics,” “Freezing Vegetables,” “Freezing Fruit,” and “Making Jams and Jellies.”

KEEPING FOOD SAFE AT THE MOLECULAR LEVEL

Early detection of water-related diseases can save lives and dollars. AgBioResearch scientists are assisting in this effort by developing sensors that can detect harmful pathogens in food and water before they cause widespread disease. Using nanotechnology, MSU professor Evangelyn Alocilja developed a biosensor that promises the speedy detection of deadly pathogens and toxins. The handheld device can be used in a farmer’s field to test, for example, for *Escherichia coli* (*E. coli*). Most strains are harmless, but some, such as *E. coli* O157:H7, can cause serious food poisoning in humans and can be responsible for product recalls and income losses for farmers and companies. These pathogens are often carried by water used for irrigation. If a farmer finds out that water for his crops contains *E. coli* or some other pathogen, he can take action and stop the contamination. Each test costs about \$2, significantly less than currently available technology. The biosensor also can be used for the rapid detection of a broad range of other threats, such as *Salmonella*, anthrax and tuberculosis. A commercial company is working to bring the product to market.

ADVANCING SAFETY, NUTRITIONAL VALUE OF FOOD

The Michigan food processing industry generates nearly \$25 billion in economic activity and employs some 134,000 workers at nearly 1,600 licensed facilities, according to the Michigan Department of Agriculture and Rural Development. MSU associate professor Kirk Dolan provides valuable insight and expertise on food safety and ways to add nutritional value to processed products. Dolan has been instrumental in developing computational tools to predict the fate of these nutrients, such as a tool to measure the thermal properties of foods and the use of commercial software for computations and statistics that speed up the design process and improve competitiveness. He has also helped develop food alternatives such as gluten-free flour made from dry beans and a food supplement from discarded grape pomace.

IMPROVING FOOD SAFETY FROM FARM TO FORK

With millions of Americans contracting food-borne illnesses each year, a team of MSU AgBioResearch scientists has been working to improve food safety. Elliot Ryser, professor of food science and human nutrition, is exploring ways to reduce contamination by *E. coli* O157:H7, *Salmonella* and *Listeria monocytogenes* during the processing, packaging and retail distribution of fresh fruits and vegetables. Les Bourquin, professor of food science and human nutrition, is developing food safety education and training programs for the food industry to help introduce standardized, competency-based processes. Brad Marks, professor of biosystems engineering, is working to improve pasteurization methods for low-moisture food products. The three professors are part of the recently created MSU Food Safety Group – a team comprising about 30 MSU researchers from more than 10 departments working with scientists from other universities around the world to improve food safety. The group collaborates with companies to solve particular food safety issues and investigates new technologies in areas such as food irradiation and thermal and production line processing methods.



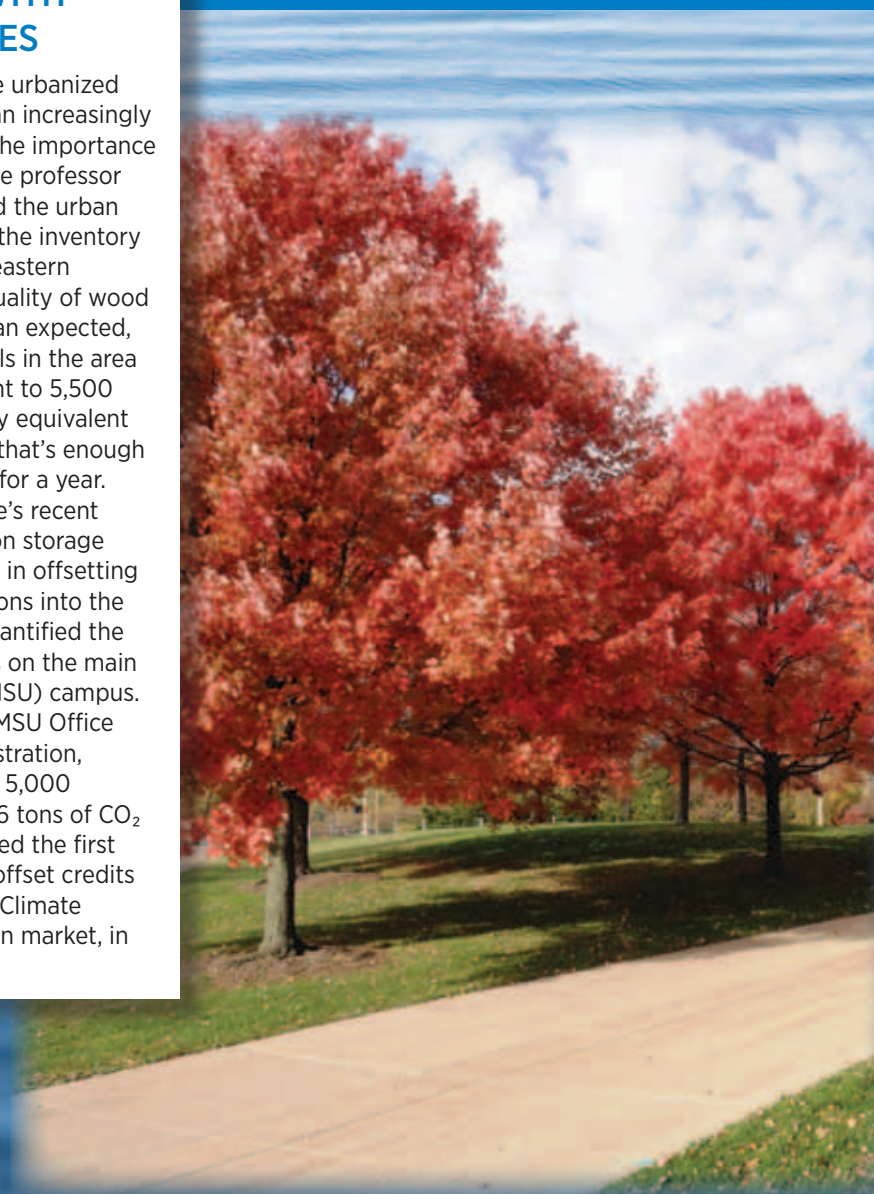
ENVIRONMENTAL QUALITY & NATURAL RESOURCES MANAGEMENT

LOOKING AT BIG WATER PICTURE BROADENS SCOPE, IMPLICATIONS FOR FRESH WATER

Limnologists have been collecting data on water bodies in the United States for more than a century. Although the information is usually applied locally to individual lakes and filed away, an MSU-led research project is under way to broaden the scope, analysis and shelf life of the data. MSU professor Patricia Soranno is spearheading a multistate endeavor to pool data on 8,000 lakes in a 17-state region in the upper Midwest and northeastern United States (an area containing many of the continent's natural lakes) gathered over the past 30 years. The enormous amount of data will be compared and analyzed to improve the understanding of some basic environmental problems such as eutrophication (a process that causes a depletion of oxygen in water) and to better protect the quality of lake ecosystems. This broad information set should also help communities better manage the effects of urban and suburban development, herbicide applications, fish stocking and regulations, and water policies.

“GOING GREEN” WITH MORE URBAN TREES

As the planet becomes more urbanized and less forested, trees are an increasingly precious resource. To show the importance of urban trees, MSU associate professor David MacFarlane conducted the urban timber inventory. Results of the inventory in a 13-county area in southeastern Michigan showed that the quality of wood in urban trees was better than expected, and that annual tree removals in the area could yield lumber equivalent to 5,500 homes per year, or an energy equivalent of 97 megawatts per year – that's enough to run the MSU power plant for a year. The other part of MacFarlane's recent research relates to the carbon storage capacity of trees and its role in offsetting carbon dioxide (CO₂) emissions into the environment. He recently quantified the carbon sequestered by trees on the main Michigan State University (MSU) campus. Using information from the MSU Office of Campus Planning Administration, MacFarlane determined that 5,000 planted trees offset about 66 tons of CO₂ equivalents. MSU then claimed the first urban forest CO₂ emissions offset credits registered with the Chicago Climate Exchange, a voluntary carbon market, in April 2010.





4-H YOUTH PRESENT NEW IDEAS FOR ENVIRONMENTAL PROTECTION

Michigan 4-H Youth Conservation Council (M4-HYCC) members traveled to Lansing in April, 2012, to present their research to two Senate committees and suggest solutions for invasive plant species in the state. “If not controlled properly, invasive plant species will take over the native species,” said Dakota Hewlett, fifth-year M4-HYCC member from Kent County. “Invasive plant species will affect our economy and tourism.” Each year, M4-HYCC members choose an environmental issue, research it and come up with potential solutions. They then present their research and solutions to the Michigan Senate. Past presentations have resulted in new regulations and new laws that protect Michigan’s environment. Simple measures that M4-HYCC members suggested to prevent transporting invasive plant species include cleaning equipment before moving to a new location, avoiding infected areas of trails when moving equipment and vehicles, keeping motorized vehicles on trails, and wearing clothing and footwear that do not pick up sticky seeds.

RESEARCHERS ADDRESS CARBON FOOTPRINT OF COWS AND PIGS

Businesses, manufacturers and farmers are working to reduce their environmental impact and offer products designed to appeal to consumer preferences. For farming operations, reducing the carbon footprint means taking a systematic approach to identifying where environmental impact occurs, what options are available for effective impact reduction and what tradeoffs occur along the way. MSU scientists and Extension staff members are asking these questions across the breadth of Michigan agriculture. At the MSU Lake City Research Station, a three-year study is under way to assess how grazing and forage management systems influence the carbon footprint of beef production. It will quantify the greenhouse gas emissions from the animals and pastures after cattle have grazed them. The researchers aim to illustrate how various systems affect animal performance, emissions and productivity of the system per unit of carbon released. A similar study looks at the diet of growing pigs to quantify how changing their diet changes greenhouse gas emissions from pig manure when it is stored and then land applied for crop production. The collection of studies will offer options to farmers to protect environmental resources while maintaining their bottom line and addressing consumer interests in a reduced carbon footprint.

FAMILY & YOUTH DEVELOPMENT

YOUTH SURROUNDED WITH POSITIVE ADULT ROLE MODELS THROUGH MENTORING PROGRAMS

Findings from the Society for Research in Child Development indicate that an estimated 8.5 million youth in America do not have caring adults in their lives. The same report states that, of that 8.5 million, only 2 million who come from disadvantaged social and economic backgrounds are engaged in mentoring programs. MSU Extension 4-H Youth Development is structured to offer mentoring to all youth who participate in its programming. To meet the critical need for formal mentoring, Michigan 4-H created several program models – individual mentoring, group mentoring, peer mentoring, community-based mentoring and site-based mentoring for youth aged 5 to 19. Formal mentoring helps to improve grades, develop communication skills, enhance leadership abilities, and encourage civic values and participation. More than 1,000 Michigan youth and 600 adults and older youth are paired in one-on-one mentoring relationships. Many 4-H mentoring programs partner with local court systems to keep troubled youth from becoming repeat offenders, potentially saving the state thousands of dollars.

SCIENCE PROGRAMS HELP YOUTH SUCCEED IN COLLEGE

Science literacy among school-aged youth in Michigan is below the national average and directly affects students' college readiness. In response, MSU Extension created and provided teachers with resource packets, aligned with Michigan science education standards by grade, along with training in how to incorporate the resources into their classroom lessons. 4-H has also responded with events such as 4-H Science Blast and National 4-H Youth Science Days throughout the state. For instance, in Bay City, students learned about wind power, a form of renewable energy. Students engineered a plan to construct a windmill, assembled the windmill, tested their design at a fan station and then made adjustments based

on their evaluation at the test station. At 4-H Discovery Camp, youths from ages 13-19 explore Michigan's natural resources and growing agriculture industry to learn how they affect energy in everyday life. "Discovery Camp was a great success – through a variety of hands-on activities and interactions with researchers and industry leaders, the youth learned about new technologies being used to address issues that affect their communities and futures," said Jacob DeDecker, MSU Extension program leader. More than 9,000 youth throughout the state have participated in 4-H science education workshops designed to prepare them for future academic success.



4-H ENCOURAGES YOUTH TO RESPOND TO COMMUNITY NEEDS

To address unmet needs within communities, Michigan 4-H youth are taking part in a nationwide movement that brings measurable, positive change: the Revolution of Responsibility. MSU Extension 4-H Youth Development works with more than 185,000 Michigan youth, helping them realize their potential and become leaders through service and learning projects. Committed to addressing real, community-based issues, Michigan 4-H youth research and develop viable solutions and then act upon them. For instance, 4-H'ers from Birch Run help their community reduce its carbon footprint by turning used cooking oil into biodiesel that is used to run farm equipment. A youth from Byron Center donated the food animals he raised to a local food pantry with assistance from community members to help alleviate food insecurity in his community. Youth in Lenawee County raised funds to buy animal catchpoles for the local police, ensuring the safety of the community, police officers and the animals. Youth in Albion lead a creative and expressive arts summer day camp, reaching out to underserved children in an at-risk community that has few resources for youth.

MSU EXTENSION PREPARES MICHIGAN'S CHILDREN FOR EDUCATIONAL SUCCESS

U.S. Department of Education statistics indicate an alarming number of young children – nearly one in five – enter kindergarten without the emergent literacy skills to be successful. Only 31 percent of Michigan fourth graders met reading proficiency standards in 2011. Children who fail to meet these standards are at risk of failing to graduate from high school on time. MSU Extension helps improve school readiness by giving parents and other caregiving adults methods of increasing early childhood literacy. MSU Extension has also distributed approximately 200,000 books to low-income children in Michigan since August 2011 through a partnership with the Molina Foundation. Studies show that children whose parents read to them, tell them stories or sing songs with them develop larger vocabularies, become better readers and perform better in school than their peers. MSU Extension has trained more than 3,400 caregivers and parents of nearly 10,000 children to help those children gain literacy skills. To ensure this learning isn't lost during summer and school breaks, Michigan 4-H sponsored summer programs to provide books to more than 10,000 children.

HELPING HOMEOWNERS FACING FORECLOSURE

The foreclosure rate in Michigan was the seventh-highest in the United States in early 2012 with almost 28,000 foreclosure-related filings in the first three months of the year. While Michigan has been among the top 10 in foreclosure filings since the housing crisis began, MSU Extension has played a key role in helping homeowners prevent foreclosure as well as navigate the foreclosure process. Based primarily in Ionia, Lapeer, Macomb and Washtenaw counties, MSU Extension educators have worked with agencies such as the U.S. Department of Housing and Urban Development as trusted partners in housing and financial literacy education. From Oct. 1, 2011 to June 30, 2012, MSU Extension educators helped more than 1,300 Michigan residents through a combination of homebuyer education workshops; classes on financial literacy, including home financing; and workshops on resolving or preventing mortgage delinquency. Extension experts often work one-on-one with clients, making sure they are aware of all of their legal options, notifying them of what federal and state assistance they might qualify for, and teaching them valuable financial literacy skills such as how to identify predatory lending practices and how to repair their credit after going through the foreclosure process.

ENERGY PRODUCTION & CONSERVATION

GENERATING CLEAN, CHEAP FUEL

Finding a way to produce clean, cheap fuel is a goal of many researchers. Plant biomass and a custom-designed production process may be the answer, according to MSU associate professor Gemma Reguera. Her research uses microbes to produce biofuel and hydrogen while consuming agricultural wastes. This process produces energy at levels more than 20 times higher than existing methods. Bioelectrochemical systems known as microbial electrolysis cells, or MECs, use bacteria to break down and ferment agricultural wastes into ethanol. The process is unique because it employs a second bacterium, which, when added to the mix, removes all the waste fermentation byproducts while generating electricity. The electricity isn't harvested as an output. It is used to generate hydrogen in the MEC to increase the energy recovery process. Reguera's fuel cells use corn stover treated by the ammonia fiber expansion process (AFEX), an advanced pretreatment technology pioneered by MSU professor Bruce Dale. AFEX uses ammonia and water under moderate pressure and heat to break down plant material. Sugars can then be extracted and converted to fuels and chemicals. Dale is working with the Michigan Biotechnology Institute to scale up the production process. Reguera continues to optimize her MECs so they, too, can be scaled up on a commercial basis.

FINDING SOLUTIONS TO RISING GREENHOUSE ENERGY COSTS

Energy is the second largest cost of production in commercial greenhouses (labor is No. 1). The majority of the energy expense in Michigan – 70 to 95 percent – is for heating; the remainder is for electricity. MSU associate professor Erik Runkle is evaluating ways to reduce heating costs so Michigan greenhouse growers can remain competitive with growers in southern and western states where energy costs are lower. The research focuses on improving the greenhouse facility, amending maintenance procedures, investing in new technologies and optimizing the greenhouse environment. The current work also focuses on lighting. Plants perceive light differently than humans, and manipulating light can be used to drive the flowering process and shorten the amount of time it takes to get a plant to market, which in turn lowers energy costs and frees up space in the greenhouse. One project involves how plants respond to red and far red light and will help determine the most desirable spectrum for low-intensity lighting to stimulate flowering. The research is supported by Project GREEN and a \$2.44 million grant from the U.S. Department of Agriculture.



PREPARING FOR THE FUTURE WITH CONSOLIDATED BIOPROCESSING

New harvesting strategies can help Michigan farmers be better prepared for the future. One example is MSU professor Kurt Thelen's research on consolidated bioprocessing, which harvests and processes whole corn plants together as a cellulosic-plus starch feedstock to make ethanol. With consolidated processing, the whole corn plant – the grain, the stalks, the leaves, everything – is harvested and taken to a biorefinery in one trip. Normally the corn grain is harvested and then the stover is harvested later, but it is difficult to get all of the stover that way. One trip through the field means that growers not only harvest more of the plant but also save time and energy with one trip across the field and one trip to the refinery. Limiting the number of times that equipment crosses the field can benefit soil structure. On the other hand, the potential negative effects of removing all the biomass from the field may be the loss of carbon and the reduction of organic matter levels in the soil. Research shows, however, that integrated cover crops or animal manures can help to recover soil carbon.

IRONING OUT THE PHOSPHORUS PROBLEM

Within the past 50 years, eutrophication – the over-enrichment of water bodies by nutrients such as phosphorus – has emerged as one of the leading causes of water quality impairment. Although many states, including Michigan, regulate the use of phosphorus in items such as detergents and fertilizer, it remains a critical environmental problem, in part because of its presence in human and animal wastes. Discharge and runoff of wastewater into lakes and streams can cause eutrophication, making the water unsuitable for recreational purposes, reducing fish populations and causing excessive algae growth. MSU associate professor Steve Safferman and colleagues at MetaMateria Technologies, based in Columbus, Ohio, are developing a new, cost-effective method of removing phosphorous from wastewater and recovering and reusing the phosphorous as fertilizer. The team has figured out how to produce a medium enhanced with nanoparticles composed of iron that can efficiently remove significant amounts of phosphorous from water. Research suggests that this method of phosphorous retrieval is much more cost-effective than processing phosphate rock. At the same time, it has the added benefit of helping to solve a serious environmental problem. The material should be commercially available for use within two years.

EAT HEALTHY, YOUR KIDS ARE WATCHING

A recent MSU study says that if lower-income mothers want kids with healthy diets, it's best for them to adopt healthy eating habits themselves and encourage their children to eat good foods rather than to use force, rewards or punishments. The results of the study – one of a few that focuses on the eating habits of low-income families – demonstrated that mothers who led by example and persuaded rather than ordered their kids to eat fruits and vegetables had kids with healthier diets. Overtly restricting certain foods from a child when others are eating them at mealtimes can lead to unhealthy eating. The study suggested maintaining regular meal and snack times, offering small portions of healthy foods and allowing the children to decide how much they will eat. Other ways to get children interested in having a healthy diet are to take them to the grocery store or garden and help them select new foods to taste and help cook at home. Developing home-based and interactive educational materials for parents who want to encourage healthful eating is the next step.

DIABETES MANAGEMENT AND PREVENTION PROGRAMS SAVE LIVES AND DOLLARS

Diabetes is a health crisis in Michigan. A 2010 report from the Michigan Department of Community Health estimates there are 716,300 people in Michigan with diabetes, and another 372,000 who are undiagnosed. The estimated cost to Michigan of treating them is \$8.2 billion, which is expected to triple over the next 25 years. MSU Extension has responded to this crisis with three programs. The five-week Michigan Diabetes Prevention Course was developed by the Michigan Department of Community Health and is facilitated by trained MSU Extension educators. It promotes healthy eating, physical activity, slow, steady weight loss and goal setting for those who are at risk for Type 2 diabetes. Through the five-session Dining with Diabetes course, diabetics and their families learn to prepare healthy meals, the causes of diabetes and how to manage the disease. Personal Action Toward Health (PATH) is a six-week series that provides the skills and tools to manage chronic health conditions, including diabetes. In 2011, MSU Extension diabetes educators taught nearly 70 multi-week course series. PATH participants reported a significant reduction in fatigue, pain and shortness of breath. More than 40 percent of them reported increasing their physical activity.

HEALTHY EATING PROGRAMS ARE ON MSU EXTENSION'S PLATE

According to the Michigan Healthy Eating and Physical Activity Strategic Plan, 80 percent of Michigan adults don't eat enough fruits and vegetables. This contributed to Michigan's position as the state with the fifth highest adult obesity in 2011, according to the CDC. In fact, three of every 10 Michigan adults are obese. Michigan's youth are also at risk, as nearly one in eight is obese. MSU Extension programs that encourage healthy eating are numerous, including Michigan Fresh, the Breastfeeding Initiative, Show Me Nutrition, Cooking Matters and Michigan Good Food. Jump Into Foods and Fitness (JIFF) is aimed at youth and promotes healthy eating and increased physical activity. Through SNAP-Ed, thousands of Michigan residents – youth and adults – learn how to eat healthier and make better use of food dollars. Eating Right is Basic piloted a version of its healthy eating course in two Michigan counties. The successful program is now being rolled out to the rest of the state. Pilot program participants reported eating more fruits, vegetables and whole grains, as well as increased physical activity.



BETTER PACKAGING COULD HELP REDUCE MEDICATION ERRORS

Medical errors cause the deaths of as many as 98,000 Americans each year at an estimated cost of \$20 billion, according to the Institute of Medicine. A multidisciplinary endeavor is under way, led by MSU associate professor Laura Bix, to examine medical packaging in an effort to improve healthcare and reduce errors, particularly during emergency situations. Packaging design elements are being studied to determine how they influence behavior. Front-of-package nutrition labeling is one aspect receiving close attention. Researchers are gauging consumer responsiveness to a traffic light system to convey nutritional content in a truncated form. Green lights suggest foods low in salt, sugar, fat and saturated fats, amber denotes moderate levels, and red indicates high amounts. The study also looks at the impact of an icon with three levels of facial expression: a smile designates low levels of salt, sugar, fat and saturated fats, a straight mouth signifies moderate levels, and a frown denotes high levels. Bix believes that these and other packaging modifications may help reduce medication errors and have significant payoffs for the healthcare industry.

BULLYING AND ANGER MANAGEMENT PROGRAMS LOWER RISK OF VIOLENCE

In 2011, 22.7 percent of Michigan high school students reported being bullied on school property within the past 12 months. Bullying reported by middle school students was even higher. MSU Extension's Be SAFE program is a bullying prevention and education program for adolescents and the adults who work with them. The program focuses on working with youth and adults involved in out-of-school settings such as afterschool programs, 4-H clubs, Boys and Girls Clubs, Scouts and faith-based groups. How individuals handle their anger affects a radius of people around them. In 2010, 101,175 domestic offenses were reported in Michigan. More than 900,000 children are victimized by abuse and neglect per year. MSU Extension developed a four-course curriculum called Alternatives to Anger, an educational series designed to help adults including parents and caregivers increase their knowledge about anger issues and put anger management and healthy relationship skills into practice. Participants learn what triggers anger, calming and de-stressing methods, principles of problem solving, forgiving and letting go of the past. Some attendees are court-mandated and the program can help lower rates of recidivism.

MSU TARGETS GROWING OBESITY PROBLEM

MSU Extension and AgBioResearch have made obesity issues a priority. In Genesee and Saginaw counties, 34 percent of adults were considered obese in 2011 – the highest in the state. MSU Extension developed, Eat Right – Active Life, a 10-week pilot nutrition education program designed to reduce an individual's Body Mass Index (BMI). At least 29 obesity reduction class series were conducted in the two counties in 2011. Outcomes included a decrease in the average hours per day watching TV; an increase in moderate- or vigorous-intensity activities; an increase in healthy eating and drinking habits; moderate weight loss; and lower BMI. One impact of obesity is a greater risk of colon cancer. MSU assistant professor Jenifer Fenton's research has shown that leptin, a key hormone in fat tissue, can promote tumor growth and cancer progression, indicating that obesity is a risk factor. Some 100,000 people in the United States are diagnosed with colon cancer each year, and nearly half will die from the disease. Fenton is helping to improve the odds of survival and decrease the overall incidence of colon cancer through her research. Eventually, Fenton wants to establish serum markers that identify people who are likely to develop colon cancer and/or polyps.

FOR MORE INFORMATION

MSU AgBioResearch

446 W. Circle Drive, Room 109
East Lansing, MI 48824-1039
Email: whetst11@msu.edu
Phone: 517-355-0123

MSU Extension

ANR Communications

446 W. Circle Drive, Room 310
East Lansing, MI 48824-1039
Email: anrcommunications@anr.msu.edu
Phone: 517-432-1555

PRODUCTION CREDITS

- » Jane L. DePriest
 - » Val Osowski
 - » Holly Whetstone
- MSU AgBioResearch**
- » Katie Alexander
 - » Maddie Brady
 - » Sean Corp
 - » Michelle Lavra
- » Mindy Maxwell Pratt
- » Laura Probyn
 - » Beth Stuever
- Agriculture and
Natural Resources
Communications at MSU**
- Leslie Johnson, Editor
Marian Reiter, Design

Michigan State University

AgBio**Research**

MICHIGAN STATE
UNIVERSITY

Extension

MSU is an affirmative-action, equal-opportunity employer, committed to achieving excellence through a diverse workforce and inclusive culture that encourages all people to reach their full potential. Michigan State University Extension programs and materials are open to all without regard to race, color, national origin, gender, gender identity, religion, age, height, weight, disability, political beliefs, sexual orientation, marital status, family status or veteran status. Issued in furtherance of MSU Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Thomas G. Coon, Director, MSU Extension, East Lansing, MI 48824. This information is for educational purposes only. Reference to commercial products or trade names does not imply endorsement by MSU Extension or bias against those not mentioned.