

# Michigan State University Combined Research and Extension Plan of Work 2020-2024

**Status: Final**  
**Date: 11/22/2019**

## I. Plan Overview

### 1. Executive Summary

#### INTRODUCTION

Michigan State University (MSU) was founded in 1855 as the Agricultural College of the State of Michigan and served as a model for the creation of the land-grant university system. While its founding predates the creation of the nation's land grant colleges, it was founded with the same mission as the land grant system. While the challenges facing Michigan, the United States, and the world have changed, the need for research and Extension responsive to these needs remains. Today we remain dedicated to the mission of teaching, training, and educating the next generation of farmers and those already working in the agricultural industry. Providing this education remains our highest priority and provides the motivation for all that we do. We continuously strive for excellence in all that we do and are proud to be ranked the #11 top agriculture college in the world, #5 in the U.S. and #2 in the Big Ten, according to QS Rankings.

Producing some 300 different types of commodities, Michigan is second only to California in terms of its agricultural diversity. These industries range from field crops such as corn, wheat, and soybeans to fruits such as cherries, apples, grapes, and blueberries; to dairy, livestock, honey, and fish; and vegetable crops, along with turf, ornamental trees, and flowering plants. The extensiveness of Michigan agricultural enterprise requires extensive research and outreach on various topics to remain competitive and vibrant.

Consequently, the industry also generates a significant economic impact for the state. The food and agriculture system accounts for \$104.7 billion in direct, indirect and induced economic activity per year and approximately 805,000 jobs – or 17 percent of total employment in Michigan. Helping to ensure the continued prosperity of these operations and businesses, through timely research and outreach among other things, is critical to the financial vitality of the state. Dairy and livestock comprise the two largest sectors of the farm economy in Michigan, contributing about \$5.1 billion total impact per year. Field crops are the second largest sector of the Michigan farm economy and an important input in livestock production. Fruit production is the third largest economic sector.

Weather patterns vary tremendously across the state. Temperatures and precipitation patterns can be markedly different from the northern tip of the Upper Peninsula to the southern border of the Lower Peninsula. Soil types also run the gamut from sandy to rocky depending on geographic locations. Therefore, what works for a farm in Marquette may not apply to one in Benton Harbor, even if they are similar types of operations. Providing best practices guidelines and treatment recommendations in broad strokes does not really work well in Michigan. Research and outreach must be regionally relevant to the industry.

Surrounded by the Great Lakes, Michigan is defined by water. The water causes what's known as a lake effect across Michigan and helps to moderate temperatures for modifying the growing season, creating many microclimates that allow Michigan producers to grow a wide variety of crops. Without those major bodies of fresh water, much of the state's agriculture, shipping, and tourism offerings would not exist. Discovering ways to protect crops and livestock without contaminating the state's numerous waterways and rich natural resources remains a high research and outreach priority.

#### ADVANCING MICHIGAN AGRICULTURE

MSU AgBioResearch and MSU Extension have been instrumental in advancing agriculture in Michigan since the university's beginning. In fact, MSU AgBioResearch was founded as the Michigan Agricultural Experiment Station in 1888

as part of a nationwide network of research stations specifically established to advance agriculture technology. Today, the impact of this work expands across the nation and even worldwide.

The mission of MSU AgBioResearch is to engage in innovative, leading-edge research that combines scientific expertise with practical experience to generate economic prosperity, sustain natural resources, and enhance the quality of life in Michigan, the nation, and the world. As we like to say “fundamental research with an intended outcome”. All of our research is aimed at solving a problem or creating a new opportunity. The 340 plus researchers across campus strive to maintain a balance between basic and applied research and rely heavily on the input of their constituents in identifying research priorities.

MSU AgBioResearch has faculty members from across campus, including the following colleges: Agriculture and Natural Resources; Natural Science; Engineering; Veterinary Medicine; Social Science; Communication Arts and Sciences; Arts and Letters; and Osteopathic Medicine

In addition to numerous on-campus research facilities, MSU AgBioResearch manages 14 outlying research centers throughout Michigan, three of which are located in the Upper Peninsula. Each of these research centers are strategically located, equipped, and staffed to address a specific segment of the Michigan agricultural and natural resource industries. We strive to maintain strong connections to local communities and industries at each location.

MSU AgBioResearch's total budget for FY 2017-2018 was \$118.1 million, with this report representing \$6.9 million in federal formula dollars and equivalent match.

Michigan State University Extension helps improve people's lives through an educational process that applies knowledge to critical issues, needs, and opportunities. For more than 100 years, MSU Extension faculty and staff members have been actively reaching people where they are – in their homes, farms, businesses, and communities – with research-driven education. We help people perform their jobs better, raise healthy and safe families, build stronger communities, and empower children to dream of brighter futures.

MSU Extension's total funding in 2017-2018 was over \$85.35 million with this report representing \$9.2 million federal formula dollars and equivalent match.

## PARTNERING BEYOND MSU

MSU AgBioResearch and MSU Extension frequently partner with other Michigan entities to help drive progress. Together, we have created a statewide, cohesive plan that uses the MSU research capability and knowledge base to expand outreach. This plan fosters economic development, improved quality of life, a healthy environment, and a plentiful and secure food supply for Michigan residents.

Both organizations have long-standing traditions of working closely with Michigan commodity organizations to ensure that the research and outcomes are meeting the needs of their farmer-members, especially the emergent, pressing issues. The successes and accomplishments of these two organizations are greatly tied to close partnerships with each other, as well as state agencies, commodity groups, extramural funding agencies, such as USDA NIFA, and other stakeholders, plus outstanding legislative support. Strengthening those bonds continues to be a priority.

MSU AgBioResearch and MSU Extension have a unique partnership with the Michigan Department of Agriculture and Rural Development (MDARD) on Project GREEN (Generating Research and Extension to meet Economic and Environmental Needs), a cooperative effort to benefit plant-based commodity industries within Michigan. Last year Project GREEN celebrated its 20th anniversary with more than \$2.5 billion worth of economic impact to Michigan over the course of its existence. We also partner with MDARD, Michigan Farm Bureau, and eight industry organizations on the Michigan Alliance for Animal Agriculture (M-AAA) to conduct research to advance Michigan animal agriculture. Since forming in 2014, M-AAA has generated a \$10 return on every \$1 invested. These programs provide seed grant funding that enable many of the researchers to establish primary findings and equip them to go on to receive other larger grants.

MSU is also committed to collaborating with other universities. In the past year, MSU and the Robert B. Annis Water

Resources Institute of Grand Valley State University formalized a partnership to collaborate on water-related issues. MSU AgBioResearch, MSU Extension, and the rest of the university are delving even deeper into water research and positioning ourselves as leaders in addressing one of the century's most important challenges - securing a safe and plentiful water supply.

MSU is also dedicated to creating new opportunities for our industry and growers. In recent years we have initiated programs on hops (Michigan is now the fourth largest producer in the US), malting barley, and new fruit crops. Currently we are developing research and Extension programs to support the developing industrial hemp business and will continue to respond as the laws and opportunities surrounding hemp evolve.

MSU's Institute of Agricultural Technology (IAT) is celebrating 125 years of providing practical agriculture training to students. While the first courses were developed for dairy management and learning to process milk and cheese, today IAT has 13 certificate programs available at 12 community college locations across the state. Demand for agricultural technicians is expected to continue to grow in the near future.

## KEY EFFORTS

### Addressing Animal Agriculture Needs

M-AAA is a partnership among Michigan animal agriculture industries, Michigan State University College of Agriculture and Natural Resources, MSU College of Veterinary Medicine, MSU AgBioResearch and MSU Extension focused on the advancement of the Michigan animal agriculture economy. Partners include: Michigan Allied Poultry Industries, Michigan Cattlemen's Association, Michigan Farm Bureau, Michigan Horse Council, Michigan Meat Association, Michigan Milk Producers Association, Michigan Pork Producers, Michigan Sheep Breeders Association, Michigan Soybean Promotion Committee (associate member) and the Michigan Department of Agriculture and Rural Development. With competitive grant funding starting in 2015, the State of Michigan invested in M-AAA research to advance the animal agriculture industry from fiscal years 2017 to 2019. Some examples of M-AAA projects include:

- Animal housing standards - By April 1, 2020, all Michigan producers will need to house pregnant pigs in pens where they can turn about freely, something typically not found in most current operations. Producers are now transitioning to group housing. And though pigs are social by nature, they don't always get along well in group settings. Researchers at MSU, alongside collaborators, are developing a host of tools to identify pigs suitable for group housing that are more likely to live in harmony. The basis for the solution may be rooted in genetics.

- Managing diseases such as bovine leukemia - A survey of 113 Michigan dairy herds found an 88 percent herd-level prevalence of bovine leukemia virus (BLV) — a retrovirus that causes infection in dairy and beef cattle that can lead to more devastating diseases. Evidence is mounting that BLV infection negatively affects milk production and longevity. By educating producers about BLV and its potential effects on their operations, they will be able to identify BLV in their herds and develop control strategies with the help of veterinarians and MSU experts. Since BLV prevalence is not easily predicted, producers need systematic monitoring such as the BLV Herd Profile Test to stay ahead of this disease.

- Increasing efficiency of fertility programs - Infertility of lactating cows is an issue that limits both profitability and sustainability of dairy farms. In response, researchers developed fertility programs to control ovarian development. These programs allow well-managed dairy farms to increase cow fertility to that of virgin heifers. Additionally, they decrease pregnancy loss and twinning — both detrimental to profit of dairy farms. Using these fertility programs over time can reduce the number of cows in a herd with excessive body condition loss, revolutionize reproductive management of dairy cattle and improve farm revenues. For example, an 800-cow dairy could expect a projected increase in revenue of \$150 per cow, per year.

### Farm Stress Management

MSU Extension began addressing farm stress due to an increase in Michigan farmers dying by suicide. To help respond to

the needs of Michigan farmers and their families, MSU Extension developed the Communicating with Farmers Under Stress workshop designed for people who work with agricultural producers and farm families to help them learn more about managing stress and communicating with those in need. More recently, MSU Extension created Weathering the Storm in Agriculture: How to Cultivate a Productive Mindset. This curriculum provides tools, resources, and information for farmers and their families to help guide them through difficult situations. Both curricula highlight existing resources and programs including MSU Extension's Stress Less with Mindfulness that introduces participants to the experience and practice of mindfulness to reduce stress. In an effort to help support Michigan residents with information on opioid misuse, MSU Extension offers educational programs and facilitates critical partnerships with community groups. Community film screening and panel discussion events engage with audiences throughout the state to discuss substance use issues. Personal Action Toward Health (PATH) programs equip participants with the skills and tools needed to face the daily challenges of living with one or more chronic conditions.

In 2018, four opioid documentary film screening series were hosted in Genesee County, Macomb County, Manistee County, and Crawford County. Film screening events reached over 200 participants and were hosted in partnership with local substance misuse prevention coalitions.

### Greenhouse Renovations and Additions

MSU will renovate and expand the plant science greenhouses to modernize and expand this capital asset that supports research, teaching, and learning. MSU is a global leader in plant sciences, supporting agriculture in Michigan and across the globe. Investment in this core research and teaching resource supports continued efforts in the plant sciences and provides the tools necessary to address a grand challenge facing the world - to safely and securely feed a world population expected to exceed 9 billion by 2050.

New state-of-the-art greenhouse space will reduce the pressure on our growth chamber resources. The campus growth chamber users committee recently estimated that additional greenhouse space would immediately release 25-30 percent of the chamber space back to its highest and best use. The current infrastructure and capacity of the greenhouses limit the university's ability to meet the needs of the Michigan agricultural community, conduct critical research, and provide high-quality plant science teaching facilities.

Approximately two-thirds of the greenhouse facilities were built between 1955 and 1978 and require reinvestment. Furthermore, greenhouse space with necessary capabilities to facilitate research on resilience in agronomic crops and precisely control multiple environmental variables is not currently available on campus. Renovation and expansion of the Plant Science Greenhouse Complex is critical to MSU maintaining its status as a world leader in plant science research. The status quo is not conducive with short and long-term plans for increased excellence in this important signature research program at MSU.

### Science Literacy and Engagement

According to a survey conducted by the Center for Food Integrity, 80 percent of U.S. consumers want to know more about their food and how it was grown but lack a direct connection to agriculture. MSU AgBioResearch is helping to bridge that gap through a new initiative. Food@MSU brings attention and increases awareness of the breadth and depth of MSU's food research portfolio. Twice a year we conduct the MSU Food Literacy and Engagement Poll to gauge U.S. consumers' knowledge of and behavior toward food. We also award \$20,000 in seed grants to researchers who work between the colleges of Agriculture and Natural Resources, and Arts and Letters.

To help cut through some of the conflicting information about our global food system, we also conduct Our Table conversations on various food-related topics, including food safety, GMOs, and food waste. These community conversations take place around a table custom-made for the initiative from fallen trees on the MSU campus. It is our goal to meet consumers where they are, and help provide the tools they need to be better informed on what to put on their plates.

## Chronic Wasting Disease (CWD)

Michigan State University is partnering with the Michigan Department of Natural Resources (MDNR) to address chronic wasting disease (CWD). Although first detected in free-range deer in Michigan in 2015, CWD was identified in the U.S. in captive deer in 1960 and wild deer in 1981.

CWD is a fatal neurological disease that affects cervids (deer, elk and moose). It causes a degeneration of the brain, resulting in emaciation, abnormal behavior, loss of bodily functions and death. Most deer do not exhibit these signs until later stages of the disease and can be infectious much earlier.

MSU researchers Drs. William Porter, David Williams and Sonja Christensen with the Boone and Crockett Quantitative Wildlife Center are partnering with the MDNR to tackle critical CWD issues.

- Early Detection - As CWD remains emergent in Michigan, scientists are using quantitative modeling techniques to address risk factors that include both natural deer ecology and human interactions with deer, such as movement of harvested or captive cervids. This helps inform where and why disease may be spreading.
- Sharpen Focus of Removal Actions - Researchers are working with management agencies to evaluate and develop cost-effective options and understand how to minimize direct and indirect transmission of CWD.
- Assess the Role of Deer Behavior in Michigan - Researchers are placing location-tracking collars on white-tailed deer in and around Meridian Township where the first case of CWD in wild deer was found. As part of a multiyear study, data on deer movement, survival and distribution patterns will inform how disease may be spread among deer.
- Evaluating a Multi-Disease Landscape - In 2012, thousands of deer died due to epizootic hemorrhagic disease (EHD). EHD is caused by a virus transmitted by insect bites. Researchers want to know how the timing and distribution of EHD and CWD are interacting and affecting deer populations.

## 2. FTE Estimates

Year	1862 Extension	1862 Research
2020	200.0	110.0
2021	195.0	112.0
2022	190.0	112.0
2023	185.0	110.0
2024	185.0	110.0

## II. Merit / Peer Review Process

All researchers and other personnel funded by MSU AgBioResearch and Extension are subjected to thorough annual reviews as mandated by Michigan State University. These processes are regularly reviewed to maximize effectiveness and to enhance the opportunity for employee development. For faculty and staff with departmental affiliations, all raises are based on merit and include reviews at both the department and college levels. In recent years, these reviews have been standardized to ensure consistency and transparency both within and among our cooperating academic units.

All AgBioResearch research project plans are peer reviewed at the department and experiment station level on a five-year renewal cycle. The alignment with the USDA Knowledge Areas has been stressed in recent years. We have also updated our guidelines for plan preparation to increase the quality and relevance of the research. To improve the quality of the proposals submitted to competitive programs we have continued to increase our investment in our Office of Research Support. Our staff now includes 4 FTE focusing on pre-award support, 2 FTE on post-award support, and 1 FTE in

program evaluation and metrics.

MSU Extension uses several continuous processes that assist in setting priorities and evaluating program goals and plans. At the county level, the public, local government officials, advisory group members, extension council members, staff members, and industry experts are involved in both the stakeholder process and review of the county and individual agents' plans. Each of MSU Extension's Institute content area work teams review the county needs, agents' plans, and research to support these programs, as well as others that may reflect emerging trends. Collectively, these plans are reviewed by MSU Extension institute and district directors who not only evaluate them, but use them in their regional and statewide presentations to describe future plans.

### **III. Stakeholder Input**

#### **1. Actions to Seek**

- On a statewide level, in 2016 MSU Extension executed an Issues Identification process, whereby an online survey and a series of statewide focus groups elicited feedback from external stakeholders. The online survey resulted in 7,180 responses from our community. Results include a ranking of statewide priorities, as well as specific programmatic feedback. There were also 52 focus groups held across Michigan, including approximately 1,200 participants, resulting in the identification of priorities by stakeholders for each MSU Extension district. The data collected from this process will enable MSU Extension and AgBioResearch to identify community needs, priorities for the future, and relevancy of existing programs to direct efforts for the next several years.

- To address more local or district needs, MSU Extension has created District Advisory Groups to help in gathering input and setting priorities. Local 4-H programs will also continue to utilize county expansion and review stakeholder advisory committees to guide the direction of the local 4-H program.

- MSU AgBioResearch continuously gathers stakeholder input through regular interactions with commodity groups, agricultural and natural resource organizations, partner agencies and research center advisory groups. These interactions have significant impacts on our programming decisions. Of special note are Project GREEN (Generating Research and Extension to meet Economic and Environmental Needs) and the Michigan Alliance for Animal Agriculture where stakeholders submit specific priorities and participate in the project review process.

#### **2. Methods to Identify**

- MSU Extension and AgBioResearch Issues Identification process utilizes statewide surveys and citizen focus groups to identify the major issues and opportunities in Michigan and assign a priority ranking to each. Also through this process, additional focus groups were held targeting underrepresented audiences in MSU Extension programming, yielding input on how future program efforts can better meet the needs of these groups.

- Regular interaction with the groups mentioned above: We sit on boards and committees that give us regular feedback on programs and priorities. We also strive to be accessible as needs arise.

#### **3. Methods to Collect**

- Through the Issues Identification process, MSU Extension and AgBioResearch elicited feedback from stakeholders via online surveys and community focus groups, yielding both quantitative and qualitative data on programming priorities.

- To address local county or district needs, local staff regularly elicit feedback from stakeholders via open meetings and advisory committee conversations.

#### **4. How Considered**

- MSU Extension utilizes stakeholder input in the development of work team logic models that become the framework for individual educators and specialists to align with, as well as help to identify local needs that may be specific to a certain county or district. Issues Identification survey and focus group results have been used, and will continue to be used, to develop logic models for specific program priorities.

- At the local county level, staff utilize stakeholder input and feedback to determine the direction of local programming.

## IV. Critical Issues

### 1 Water Quality and Quantity

#### Description:

Michigan has more than 36 million acres of land with more than 11,000 inland lakes and 36,000 miles of streams. Assuring water quality so that the state's water resources support designated uses such as drinking, recreation, and ecological health is a long-term concern. We will:

Increase participants' understanding of ecology, natural resources management and decision-making, ecosystems and processes, and contested issues

Increase participants' awareness of the impacts their actions have on water resources

Determine the best way to remove pollutants from soil and water and turn over these areas into safe, productive sites

Keep Michigan's surface and groundwater clean and make all citizens aware of why this is a critical issue

Ensure that a safe, secure and plentiful water supply is available for the state's citizens, industries, wildlife, and natural areas

**Term:** Long

#### Science Emphasis Areas

Agroclimate Science

Environmental Systems

### 2 Plant and Animal Production and Health

#### Description:

Michigan produces approximately 300 commodities, making the state second only to California in terms of crop diversity. Agriculture is one of the fastest growing sectors of the Michigan economy. Animal agriculture and its associated products -- milk, meat, wool, eggs, cheese, and butter -- also make up a significant portion of Michigan's economy. We will:

Increase farmers' success with protecting the environment, ensuring food safety, reaching new markets, and advancing agriculture through applied research

Conduct research on selecting plants and animals with desirable traits and on new methods to combat diseases and parasites

Study nutrition and animal management systems

Develop integrated crop and soil management systems to meet production and environmental goals.

**Term:** Long

#### Science Emphasis Areas

Agroclimate Science

Environmental Systems

Sustainable Agricultural Production Systems

### 3 Secure Food and Fiber Systems

#### Description:

Our expertise in biosystems engineering, food processing, and nutritional immunology is paving the way for the creation of new food products that offer Michigan residents food choices with greater health benefits. Engineering and processing advances will lead to greater cost efficiencies, enhanced food safety and security, and increased development of non-food products (e.g., biofuels, building materials). We will:

Enhance the production and profitability of small-scale agriculture projects and improve community wellness  
Use educational processes to facilitate the incorporation of renewable energy into households, governmental offices, and businesses  
Increase the capacity to develop forest and agricultural-based renewable resources in ecologically and economically sustainable ways.

**Term:** Long

**Science Emphasis Areas**

Agroclimate Science  
Bioeconomy, Bioenergy, and Bioproducts  
Environmental Systems  
Food Safety  
Sustainable Agricultural Production Systems

**4 Human Health, Youth, and Families**

**Description:**

Promoting well-being for Michigan's youth and families requires attending to individuals' physical, social-emotional, and behavioral health. To improve the health and safety of Michigan's adults, youth, and families, we developed broad and comprehensive research and education programs to address Michigan residents' needs. Youth development, community development, nutrition and food safety research and education, and family and parenting skills are important areas of focus. We will:

Support Michigan residents in eating healthier, being better caregivers, and preventing and managing chronic health conditions through education  
Develop better models for the human health and human services sectors  
Study the function of nutrients and other components related to human health  
Improve management of financial resources by individuals and families through education  
Prepare youth for life and work

**Term:** Long

**Science Emphasis Areas**

Education and Multicultural Alliances  
Family & Consumer Sciences  
Food Safety  
Human Nutrition  
Youth Development

**5 Environmental Stewardship and Natural Resources Management**

**Description:**

Michigan's natural resources are a fundamental asset for the state's future economic opportunities. Challenges concern how residents of the state can best benefit from its rich natural heritage without overburdening the carrying capacity of its natural systems and reducing opportunities for residents and visitors alike. Our natural



resource programs improve public understanding, help landowners and communities use those assets for sustainable long-term social and economic development, and conserve natural resources for future generations. We will:

Develop tools and technology to help Michigan's natural resource-based tourism industry grow by meeting consumer demands

Determine how wildlife, fisheries, forest and natural resources areas respond to habitat management to encourage management for sustainable benefits

**Term:** Long

**Science Emphasis Areas**

Bioeconomy, Bioenergy, and Bioproducts  
Environmental Systems

**6 Workforce Development, Community Resource Development, and Innovation**

**Description:**

Successful and thriving communities combine knowledgeable and engaged legislators, businesses, community groups, and residents. Agricultural producers benefit from improving their business and financial management skills, whether they raise dairy cows or grow blueberries. Marketing, distribution and other economic variables also play a critical role in the success and profitability of the state's agriculture and natural resources industries. We will:

Assist entrepreneurs who develop and commercialize high-value, consumer-responsive products and businesses  
Research and provide education on international trade and development, economic policy, domestic and foreign policy, and community resource planning and development to help Michigan growers and producers navigate governmental regulations both here and abroad, as well as connect them with foreign buyers and markets  
Assist Michigan communities in making critical policy decisions and functioning more smoothly with citizen involvement.

**Term:** Long

**Science Emphasis Areas**

Education and Multicultural Alliances  
Family & Consumer Sciences  
Sustainable Agricultural Production Systems