

2017 Michigan State University Combined Research and Extension Plan of Work

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I. Plan Overview

1. Brief Summary about Plan Of Work

Michigan State University AgBioResearch (ABR) conducts leading-edge research that combines scientific expertise with an understanding of real-world problems in the key areas of **FOOD, ENERGY** and the **ENVIRONMENT**. The research strives to find viable, workable solutions in many diverse areas from entomology and packaging to microbiology and nutrition. The multidisciplinary projects are led by more than 300 scientists from the following MSU colleges:

- Agriculture and Natural Resources
- Natural Science
- Veterinary Medicine
- Engineering
- Social Sciences
- Arts and Letters
- Communication Arts and Sciences

An integral part of the pioneer land-grant university, **ABR maintains a balance between basic and applied research and relies heavily on constituent and stakeholder input from the agricultural and natural resources industries** to identify priorities. An emphasis is placed on integrated and multidisciplinary endeavors with programs continually evaluated for relevance and progress to meet the changing needs of both the agriculture and natural resources industries. The accomplishments and discoveries outlined in this report are reflective of some of the reasons why ABR (founded as the Michigan Agricultural Experiment Station) continues as one of the most successful entities of its kind 125 years after its formation.

Also a vital component of the land grant mission, Michigan State University Extension (MSUE) disseminates the research knowledge to people in an effort to improve lives through an educational process that **applies knowledge to critical issues, needs and opportunities**. One of the hallmarks of MSUE is its willingness and ability to adapt programming to meet the needs of Michigan residents, communities and businesses.

Agriculture is Michigan's second largest industry. The **food and agriculture industry in Michigan is estimated to contribute more than \$100 billion to the state's economy (direct, indirect and induced) and accounts for more than an estimated 923,000 jobs**. Food and agriculture represent about 22 percent of the workforce in Michigan. With more than 300 commodities, 55,000 farms and 10 million acres of farmland, Michigan also has one of the most diverse agricultural industries in the nation. The state ranks second in the U.S. in terms of its crop diversity from fruit, vegetables and soybeans to ornamental trees, livestock and fish.

Michigan farmers, ABR scientists and MSUE educators continue to be asked to accomplish more with less. Conversely, **challenges with pests, plant diseases, processing logistics, shifting climates and**

the need for consumer education have become increasingly complex and more demanding. Leveraged and external funding is more important and more competitive to secure than ever before. ABR scientists and MSUE educators continue to demonstrate flexibility, innovation and a perseverance that equips them to respond to these challenges.

Every dollar the state invested in ABR and MSUE in 2013-14 resulted in an additional \$2.06 in federal funds and external contracts, grants and other revenues to serve Michigan residents. During that fiscal year, ABR secured \$60.4 million in external contracts and grants from such federal agencies as the U.S. Department of Agriculture (USDA), National Science Foundation (NSF) and the U.S. Agency for International Development.

At the same time, Michigan **farmers and food processors continue to report that they are optimistic about the future of their industry, according to the "Michigan Agriculture and Food Index"** completed by economists from the MSU Product Center. The index gauges the current business climate of the state's food and agricultural system. A rating of 100 on the index is considered neutral; ratings above 100 signal increasingly positive confidence, and below 100, increasingly negative confidence.

Respondents gave the overall state of food and agriculture a rating of 146, compared to Michigan's overall economy at 120. More than 80 percent of respondents are positive or very positive about the state of the system. Members of the roundtable are generally bullish on the current state of their industries. All major sectors of the state's food and agriculture system are represented in the survey: dairy, livestock, field crops, fruits and vegetables, and the nursery, floriculture and landscape industry.

In the FY2013-2014, **the state's \$56.3 million investment in ABR and MSUE generated more than \$867 million for Michigan residents.** The state's investment also allows ABR to secure external, competitive funds - further leveraging state dollars while creating opportunities to make discoveries that advance Michigan agriculture and sustain our natural resources.

http://agbioresearch.msu.edu/uploads/396/36242/Compressed_Leg_Summ.pdf

The success and accomplishments of ABR and MSUE are fueled by **close partnerships with each other, as well as linkages to state agencies, commodity groups and other stakeholders, and outstanding legislative support.** This collaboration is crucial as researchers and outreach specialists continue to tackle and address issues that rarely respect geographical borders such as food safety, invasive species and plant and animal diseases.

Estimated Number of Professional FTEs/SYs total in the State.

Year	Extension		Research	
	1862	1890	1862	1890
2017	195.0	0.0	65.0	0.0
2018	190.0	0.0	65.0	0.0
2019	185.0	0.0	66.0	0.0
2020	180.0	0.0	65.0	0.0
2021	180.0	0.0	65.0	0.0

II. Merit Review Process

1. The Merit Review Process that will be Employed during the 5-Year POW Cycle

- Internal University Panel
- External University Panel
- External Non-University Panel
- Expert Peer Review

2. Brief Explanation

The challenges facing Michigan agriculture and natural resources are increasingly complex and diverse. MSU AgBioResearch programs are continuously evaluated for relevance and progress. A strategic visioning process, linked to those of MSU AgBioResearch-affiliated colleges at MSU (Agriculture and Natural Resources, Communication Arts and Sciences, Engineering, Natural Science, Social Science and Veterinary Medicine), has identified key strategic priority areas that will drive the MSU AgBioResearch agenda over the next decade. This process also involves industry experts, university faculty members, the interested public, elected officials and MSU Extension and AgBioResearch Council members and ad hoc committees, and includes scientific review by peers (local, national and international) and industry experts. These target areas address the research priorities of Michigan agriculture, natural resources and bioeconomy industries, but are also linked to national goals and new initiatives. The target areas are: Food and Health, Environmental Stewardship and Natural Resources Policy and Management, Enhancing Profitability in Agriculture and Natural Resources, Secure Food and Fiber, and Families and Community Vitality.

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 MSUE's 26 Institute working groups (formerly Area of Expertise - AoE - teams) reviews the county needs, agents' plans, and research to support these programs, as well as others that may reflect emerging trends. In addition, the working group's goals are reviewed by state leaders and industry experts for quality and relevance. Collectively these plans are reviewed by MSUE and AgBioResearch directors who not only evaluate them, but use them in their regional and statewide presentations to describe future plans.

Jointly, MSU Extension and MSU AgBioResearch address issues of concern in local communities with research and education by using a network of citizen advisory groups at the local and state levels. District and County (especially large counties between Detroit and Flint) Extension councils identify and prioritize issues, seek collaborations and resources, and communicate to others the importance of Extension's educational programming. Citizen Advisory Councils help establish research priorities at the 13 AgBioResearch centers. The MSU Extension and AgBioResearch Council serves as a liaison among county councils, research center advisory groups and state agencies and organizations. In addition, three action teams were created to further enhance MSUE's merit review process.

- **Strategic Connections & Communications Team** - This team will determine the best practices for strategic communications for MSU Extension employees, update existing communications tools and develop new ones to help us all build and maintain our strategic

connections.

- **Issues Identification Team** - This team will frame the issue identification process that will be used with the district councils in the future. The process will help us pinpoint the issues that are important to the communities we serve and identify how MSU Extension can be involved in addressing them.

- **Team Member Accountability and Performance Feedback Team** - This team will work to improve MSUE's performance review structure and examine the role peer feedback should play in those reviews.

III. Evaluation of Multis & Joint Activities

1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

As the state's land-grant institution, MSU is charged with generating research-based knowledge and educational programs so that people can make informed decisions to improve their lives. To accomplish this important mission, MSU AgBioResearch and MSU Extension are constantly evaluating and updating the areas they focus on to best meet the ever-changing needs of Michigan's people, industries and communities. As the state's priorities change, research and educational programs, research agendas and external relationships also must change.

MSU AgBioResearch and MSU Extension work collaboratively to gather public input on the issues of greatest concern to Michigan citizens. An issues identification process of over 5,156 surveys and 40 focus groups that gathered new information to inform continuing and new research and educational programming through 2021. Both organizations continue to use and fine-tune this input to guide state-level decisions for research priorities and program support. Additional surveys, focus groups, conferences and meetings build on and enhance baseline data collected. Due to stakeholder input, MSU Extension and MSU AgBioResearch have focused more sharply on biobased products that can help boost the Michigan economy, including biofuels, chemicals, nutraceuticals and food products, as well as youth and family issues, the environment, land use issues and biotechnology. Water research and food safety are also issues that are receiving increased attention and funding resources as evidenced by the recent launches of the MetroFoodPlus Initiative and the MSU Global Water Initiative. From an operational perspective, MSU AgBioResearch has used stakeholder input to guide its decision making process around the consolidation and restructuring of its 13 research centers and various on-campus units.

2. How will the planned programs address the needs of under-served and under-represented populations of the State(s)?

Soil, Water and Natural Resources: Urban sprawl and community vitality research and education programs are partnering with local urban agencies and groups that have never worked with MSUE or MSU AgBioResearch before. Program and Institute directors have made sure that under-served people are members of advisory and planning boards. Plant Sciences: Of the 52,800 farms in Michigan, about 205 are classified as organic with 45,500 certified organic acres. Organic growers and growers who are considering incorporating more organic production practices into their operations have been asking for research on pest control methods that meet organic certification standards. In partnership with Michigan Food and Farming Systems (MIFFS), the USDA Risk Management Agency and the Black Farmers Association, programs are reaching underrepresented racial/ethnic farm operators. Economics, Marketing and Policy: Destination marketers and technology managers are non-traditional audiences. Many research programs employ multi-cultural graduate and post-graduate students. Human Health, Environment, Family, Youth, Society and Community: Individuals, families and communities that are low income, at risk, and underserved are

targeted in this area through family resource management, parenting and community development programs. 4-H afterschool programs are used to target non-traditional audiences. In the sustainability arena, we have adopted the paradigm of 'wicked problems' as a critical conceptual tool to investigate how sustainability can be achieved in both a process and content sense. In the past year, this work has been transformed into the development of a new area of research under the sponsorship of the MetroFoodPlus program, a major university-level project on sustainability related to feeding emerging metropolitan regions around the world. The work is to provide the foundation for the development of the Global Innoversity for MetroFood, an action learning network including Detroit, Mich., the Netherlands, Sao Paulo, Mairabi, Johannesburg, Hyderabad and Singapore. A significant stream of research is expected to emerge over the next several years. A main focus of the initiative is to create hubs for healthy, accessible food in areas known as food deserts in lower income communities.

3. How will the planned programs describe the expected outcomes and impacts?

Each of the planned programs have specific outcomes that are expected to happen during the joint five-year plan of work. In some programs, the specified outcomes and impacts are scheduled to happen in the first or second year, but other outcomes will continue to occur throughout the five-year period and beyond. Under each planned program, specific progress toward the outcomes and impacts are documented as objectives and milestones are reached. MSU Extension will utilize Institute Work Teams to develop logic models and plans that identify special audiences and needs, integrate research into educational outreach programming, and work with the North Central Region in building multi-state programs and indicators. 2016 State Logic Models can be seen at: <http://reporting.msue.msu.edu/miprs2016/stateplan2016.pdf> The Director's Goals can be seen at: <http://reporting.anr.msu.edu/miprs2014/Organizational-goals.pptx>

4. How will the planned programs result in improved program effectiveness and/or

MSU Extension and MSU AgBioResearch programs have a well-documented history of increasing efficiency and improving productivity, both of which result in better quality of life for the state's residents. Because of their close working relationship, MSUE education programs are research-based, and the results of MSUE programs inform AgBioResearch efforts, while basic and applied research provides innovation and new approaches to address wicked and new challenges. Specific examples of this tightly integrated interaction are provided in each planned program section.

IV. Stakeholder Input

1. Actions taken to seek stakeholder input that encourages their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of the general public

- Survey of selected individuals from the general public
- Other (Conferences and meetings, social media)

Brief explanation.

A variety of strategies and approaches were used in the past year to encourage stakeholder participation for a number of key activities and undertakings:

MSU AgBioResearch made a significant effort to increase its reach and exposure to key stakeholder groups this past year. These efforts included an email capture campaign to increase the number of email addresses (vs. snail mail addresses) that we have for our key stakeholder groups. MSU AgBioResearch also entered into a sponsorship with Greening of the Great Lakes (a WJR radio program) to expand our reach to commodity groups, industry reps, and natural resource/environmental groups. The program, which reaches a significant portion of Michigan media markets, promotes AgBioResearch and features more than 20 researcher interviews per year. We also contracted with Michigan Farm Radio Network to expand our reach to our farming constituents, and with MLive.com to do some geotargeting of our messaging with the above-mentioned groups as well as outreach to state and local elected officials.

MSU Extension continues to fine-tune a major restructuring effort to reinvent itself to better meet the challenges of the 21st century. MSU Extension staff participation was encouraged by: publishing weekly newsletters from the MSU Extension Director to share information on the progress of the restructure and to solicit staff feedback; using the MSU Extension portal to post information and collect feedback from staff; and holding Town Hall meetings at various locations across the state to discuss the MSUE restructuring plan and solicit staff input to guide the plan and to identify and develop four new institutes within the MSU Extension framework

- Preparing Michigan's Children & Youth for the Future
- Enhance Michigan's First Green Industry: Agriculture and Agribusiness
- Improve Health and Nutrition for Michigan Residents
- Greening Michigan: Leveraging Natural and Human Assets for Prosperity

To address more local or district needs, MSU Extension has created District Advisory Groups to help in gathering input and setting priorities.

Further, numerous individual meetings were held with staff, stakeholder advisory groups and the MSU Extension/AgBioResearch State Council related to the development of MSU Extension institute areas and what they should be. Meetings were also held with the Michigan Association of Counties, the Michigan Township Association and state legislators.

With the framework for the redesign and the four institutes established, a comprehensive needs assessment -- Advance Michigan -- was conducted to seek input and direction from staff, internal and external stakeholders, and the general public on what the programmatic priorities should be within each of the institutes. The survey, which will inform priorities and programs for the next five years, is being used to develop a logic model for specific program priorities in each institute and a statewide plan of work.

2(A). A brief statement of the process that will be used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups

- Open Listening Sessions
- Needs Assessments
- Use Surveys

Brief explanation.

With a mission 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, MSU AgBioResearch has an extremely broad and long list of stakeholders. In reality, every Michigan citizen is an AgBioResearch and MSU Extension stakeholder. Using the methods checked above, the emphasis is on keeping up-to-date on key internal and external stakeholders, legislative contacts and the "interested public" and using a blend of traditional and online platforms to reach individuals and groups and collect input from them.

The Advance Michigan online issues identification process (and the previous Strengthening Michigan's Economy process) and ongoing efforts offer multiple ways for people in various roles and locations to help identify the issues and opportunities for AgBioResearch priorities and MSUE educational programming during the years ahead.

Statewide surveys and citizen focus groups are used to identify the major issues and opportunities in Michigan and assign a priority ranking to each.

Community-based discussions in all Michigan counties, involving the local MSU AgBioResearch advisory committees, MSU Extension councils and others are held to discern what issues and opportunities stakeholders believe should be addressed related to research and programming. Community groups, commodity and producer groups and other state and local partners are periodically asked what specific issues and opportunities should be addressed.

Faculty focus groups, with representatives from MSU colleges and units, are held as needed to glean faculty perceptions on emerging Michigan issues and opportunities and identify ways that MSU science might address them. MSU faculty and AgBioResearch/MSUE staff surveys are used as needed to develop a better understanding of the university's ability to respond to issues identified in faculty focus groups.

County teams, including MSU AgBioResearch center managers, synthesize and submit local priorities identified by local councils and advisory committees.

Working Groups synthesize and prioritize content-specific program and research needs generated from the input of their advisory bodies and continue to fine-tune these needs as additional input is received.

2(B). A brief statement of the process that will be used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Survey of the general public
- Meeting with invited selected individuals from the general public

- Survey of selected individuals from the general public

Brief explanation.

Several methods are used to collect stakeholder input:

MSU AgBioResearch continues its significant effort to increase its reach and feedback/data collection capacity with key stakeholder groups. A new effort included an email capture campaign to increase the number of email addresses (vs. snail mail addresses) that we have for our key stakeholder groups to enhance communication channels and an exchange of information and feedback.

MSU Extension has completed a major restructuring effort to reinvent itself to better meet the challenges of the 21st century. MSUE staff participation was collected via the MSU Extension portal, Town Hall meetings at various locations across the state, numerous individual meetings with staff, stakeholder advisory groups and the AgBioResearch/MSU Extension State Council. Meetings were also held with the Michigan Association of Counties and state legislators. A comprehensive needs assessment -- AdvanceMichigan -- to seek input and direction from staff, internal and external stakeholders, and the general public on what the programmatic priorities should be within each of the institutes was launched. Survey results are being used to develop a logic model for specific program priorities in each institute and a statewide plan of work. MSU Extension has developed District Advisory Groups to assist in the development of new initiatives and set priorities. Currently a standardized data collection system is being developed to collect better information from stakeholders.

The tagline 'leading innovation in food, natural resources and energy,' conveys the breadth and relevance of the work we do while remaining true to our land-grant mission in support of Michigan agriculture.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

Brief explanation.

Stakeholder input provides the foundation for the research and educational programs developed by MSU AgBioResearch and MSU Extension.

Stakeholders help decide the future direction for MSU AgBioResearch through programs such as Project GREEN, the Animal Agriculture Initiative, the Rackham Endowment, commodity advisory teams and working groups. Due to stakeholder input, AgBioResearch has focused more sharply on biobased and renewable energy products, materials and processes that can help boost the Michigan economy, including fuels, chemicals, nutraceuticals and food products; the environment, including climate change and land use issues; and biotechnology. Stakeholder input has changed the direction of youth programming to focus on job readiness and health, which have not been traditional program areas.

For ABR, multiple meetings were held with commodity groups, legislators and key stakeholders representing the key agricultural sectors as work continued with the consolidation of management and operations for various research centers and units. In addition to these traditional, long-standing venues, an **ad hoc committee comprised of faculty members and commodity group stakeholders was established to conduct a comprehensive review of ABR centers** and to provide recommendations on how to best move forward in implementing needed changes.

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.

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Human Health, Environment, Family, Youth, Society and Community
2	Soil, Water and Natural Resources
3	Plant Sciences
4	Economics, Marketing and Policy
5	Animal Production and Protection
6	Food and Non-Food Quality, Nutrition, Engineering and Processing

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Human Health, Environment, Family, Youth, Society and Community

2. Brief summary about Planned Program

Michigan's children are among the most inactive and sedentary in the nation. Many other health risks also face children, including poor diets, teenage smoking, unintended pregnancies, infectious diseases and lead poisoning. By high school graduation, more than 80 percent of all students have been harassed or bullied by classmates. Food safety is a concern to Michigan residents, as is keeping themselves and their families safe. The past several years have been very difficult for the Michigan economy. The slumping auto industry has deeply affected the state's finances. Downturns in other manufacturing sectors and record-high gasoline prices have pushed the situation from bad to worse. To improve the health and safety of Michigan's adults, youth and communities, AgBioResearch and MSU Extension have developed broad and comprehensive research and education programs to address specific Michigan needs. Youth development, community development, nutrition and food safety research and education, and family and parenting skills are focus areas that stakeholders have identified as important.

Programs in this area will:

- Help Michigan residents eat healthier, become more active, be better caregivers, and prevent and manage chronic health conditions.
- Help develop better models for the human health and human services sectors.
- Explore how environmental pollutants, especially ozone and endocrine disruptors, affect human health.
- Study the function of nutrients and other components related to human health.
- Improve management of financial resources by individuals and families.
- Help prepare youth for life and work.
- Assist Michigan communities in making critical policy decisions and functioning more smoothly with citizen involvement.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
608	Community Resource Planning and Development	0%		8%	
702	Requirements and Function of Nutrients and Other Food Components	1%		4%	
703	Nutrition Education and Behavior	5%		3%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	1%		8%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	1%		5%	
721	Insects and Other Pests Affecting Humans	1%		2%	
723	Hazards to Human Health and Safety	7%		12%	
724	Healthy Lifestyle	11%		12%	
801	Individual and Family Resource Management	13%		0%	
802	Human Development and Family Well-Being	12%		10%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	3%		10%	
805	Community Institutions and Social Services	5%		18%	
806	Youth Development	40%		8%	
	Total	100%		100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

It is becoming increasingly apparent that the relationship between family lifestyle factors (e.g., physical living environment, education, food choices, physical activity) and general health and well-being are closely linked and critically important to understand in order to address the challenges families and communities face in this arena.

For example, the accessibility of healthy food choices varies considerably depending on an individual's geographic location. A number of recent studies have quantified and mapped links between demographics, food accessibility and diet. Research in this area is being done to analyze community demographics and then develop atlases of nutritional accessibility for cities to better inform consumers.

By the time a child is three, 85 percent of the brain is developed, but many children enter school unprepared to learn. Many parents and caregivers lack knowledge of developmentally appropriate practices, physical health and wellness, social competence, emotional well-being and cognitive development. Families lack family communication skills. Affordable, high-quality childcare supports

business productivity and quality of life for families.

According to a report of the Governor's Commission on Higher Education and Economic Growth, many students are not prepared for life and work. In a recent State of the State survey, 80 percent of respondents identified youth job training as a high priority. Tenth graders who aren't involved in extracurricular activities are 57 percent more likely to drop out of school. Michigan's high-school graduation rate is only 74 percent.

Antibiotic resistance, bacterial pathogens, food allergies and viruses continue to be issues in food safety, especially *Listeria*, *Salmonella*, *E. coli* O157:H7 and *Campylobacter*. New solutions to time-temperature control in food are needed, as are new methods to detect pathogens quickly, accurately and efficiently.

Research by the Federal Reserve indicates that household debt is at a record high relative to disposable income. The average American family carries nearly \$20,000 in credit debt. Bankruptcy rates have increased tenfold in five years. U.S. life expectancies have risen, but many people are not prepared to successfully manage their finances in anticipation of retirement. Fewer than half of all minority and low-income families own their residence.

Many communities are not prepared for the health care, housing and transportation needs of seniors.

Leaders in urban centers look for help revitalizing struggling downtowns; government officials in municipalities of all sizes need assistance with economic development. In many communities, multicultural differences are not recognized, understood and appreciated. Citizens lack awareness of the level and funding of public services, the complexity of public issues and the methods of citizen involvement.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Assumptions:

- Funding for these research projects and educational programs will remain constant or decrease; therefore, some expertise will be lost.
- The methodology used to determine program direction is sound.
- People who are trained in nutrition and food safety will change their nutritionally unsound behavior and handle food safely.
- Given appropriate information and tools, people with chronic medical conditions will manage their condition effectively.
- Financial literacy training will result in better financial decisions.
- Training parents and caregivers will improve children's readiness to enter school. •Improved parenting and family management skills will improve quality of life.
- Given accurate information, communities will act positively to meet the needs of seniors.
- Citizens and local officials who are trained will use the information learned to improve their communities.
- Helping Michigan communities of all sizes with economic development will provide improved quality of

life, a more robust economy and a more attractive business climate for Michigan.

- Preparing youth for meaningful, well-paying careers will lead to better employment opportunities, which will improve their quality of life and boost the state's economy.

2. Ultimate goal(s) of this Program

The ultimate goals of this program are:

- To ensure that all Michigan residents have access to safe, healthful, affordable food.
- To develop new tests to detect current and emerging food pathogens quickly, accurately and efficiently.
 - To help guide public health recommendations for dietary intakes of specific micronutrients and bioactive food components to prevent the development of allergic disorders, especially in the context of airway disease.
 - To better understand community capacity in the management and decision making around natural resources, specifically water and sanitation.
 - To evaluate the role of migrating waterfowl and shorebirds in the dispersal of pathogens that pose significant health threats to wild and domestic animals as well as humans.
 - To give individuals, parents and caregivers the knowledge and tools to choose healthful food, physically active lifestyles and behaviors consistent with federal dietary guidelines.
 - Individuals will gain financial literacy, management and organizational skills, including credit, budgeting, savings and investing, home buying, energy and affordable housing options. This will increase savings and reduce consumer debt.
 - To ensure that children enter school ready to learn by teaching parents and caregivers how to use developmentally appropriate practices to ensure their children's physical health and wellness, social competence, emotional well-being and cognitive development.
 - To strengthen family relationships.
 - To prepare communities to meet the health care, housing and transportation needs of seniors.
 - To prepare public officials to seek and hold office and gain knowledge about funding, the most efficient and effective ways to provide services, strategic planning, conflict management, communication, engaging the public in policy development, and intergovernmental cooperation. This will enable local public officials to be confident, efficient, effective leaders in their communities.
 - To ensure that Michigan citizens are knowledgeable, prepared and willing to serve in public roles and make good decisions.
 - To ensure that youth have the knowledge and skills needed for well-paying, fulfilling employment and to meet the challenges of a changing world, as well as enhanced physical, social, emotional and cognitive health and well-being.
 - To enhance the personal growth of youth through volunteering in community service.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

| Year | Extension | | Research | |
|------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| 2017 | 103.4 | 0.0 | 11.5 | 0.0 |

| | | | | |
|------|-------|-----|------|-----|
| 2018 | 100.7 | 0.0 | 11.5 | 0.0 |
| 2019 | 98.1 | 0.0 | 11.0 | 0.0 |
| 2020 | 95.4 | 0.0 | 11.5 | 0.0 |
| 2021 | 95.4 | 0.0 | 11.5 | 0.0 |

V(F). Planned Program (Activity)

1. Activity for the Program

Research programs to:

- Develop a better understanding of public benefits for policy development in recreation and tourism resource management.
- Increase understanding about how environmental pollutants, especially ozone and endocrine disruptors affect human health.
- Establish new programs and policies to help young people move successfully from foster care to independent living after they are too old for foster care.
- Analyze the relationships among social support, public policy and family characteristics and how they affect the function and well-being of rural low-income families.
- Increase understanding and develop more effective environmental management systems.
- Develop better models for the human health and human services sectors.
- Identify the nutritional determinants of allergic immune disorders.
- Develop an understanding of how n-3 polyunsaturated fatty acids affect human health and disease, especially cardiovascular disease and inflammation.

Educational programs to:

- Teach how to choose healthful food, physically active lifestyles and behaviors consistent with dietary guidelines.
- Teach consumers to keep their food safe by offering programs on food safety, home food preservation and healthy, hygienic food-handling practices.
- Teach people living with chronic medical conditions to manage their condition effectively.
- Teach financial literacy and prepare individuals to manage their finances in anticipation of retirement.
- Teach caregivers and parents how to prepare children for school.
- Increase access to affordable, high-quality childcare.
- Prepare communities for the health care, housing and transportation needs of seniors.
- Educate citizens and public officials about funding methods, service provision and intergovernmental cooperation.
- Provide counties and municipalities with technical assistance related to intergovernmental contracting, consolidating services and financial and strategic planning.
- Assist government officials in leadership, conflict management, communication and engaging the public in policy development.
- Prepare youth with knowledge and skills needed for life and employment.
- Enhance the physical, social, emotional and cognitive health and well-being of youth.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

| Direct Methods | Indirect Methods |
|---|---|
| <ul style="list-style-type: none"> ● Education Class ● Workshop ● Group Discussion | <ul style="list-style-type: none"> ● Newsletters ● TV Media Programs ● Web sites other than eXtension ● Other 1 (News Releases) ● Other 2 (Annual Report/Magazine) |

3. Description of targeted audience

Michigan private citizens, state agencies, farmers, food processors, commodity groups and agricultural industry representatives are targets of research programs. Individuals of all ages and life stages are targeted for healthy lifestyle and food-safety education programs. Human development and family well-being programs target parents and caregivers of preschool children, people living with chronic medical conditions and senior citizens. Community institutions, health and social services programs target citizens and public/government officials. Youth age 9 to 18 are targets of youth development programs.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of research programs on human health, environment, family, youth, society and community.
- Number of adult participants trained in healthy lifestyles.
- Number of youth participants trained in healthy lifestyles.
- Number of youth participants trained in life skills.
- Number of adult participants trained in family resource management.
- Number of youth that gain knowledge in how to respond to one's own social-emotional needs and the social-emotional needs of others
- Number of adult participants trained in youth development.
- Number of adult participants trained in home ownership education and foreclosure counseling.
- Number of youth participants trained in financial literacy and money management.
- Number of adults trained in human development and family well-being.
- Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

| O. No | Outcome Name |
|-------|--|
| 1 | Number of research programs to determine the relationship between family meals/lifestyle factors, education/food choices, general health and environmental influences, physical activity and general health. |
| 2 | Number of research programs to understand how environmental pollutants, especially ozone and endocrine disruptors, affect human health. |
| 3 | Number of research programs to develop better models for the human health and human services sector. |
| 4 | Number of adult participants with increased knowledge about healthy lifestyles. |
| 5 | Number of youth participants with increased knowledge about healthy lifestyles. |
| 6 | Number of adult participants with increased knowledge of human development and family well-being. |
| 7 | Number of youth participants with increased knowledge of life skills. |
| 8 | Number of adult participants with increased knowledge of youth development. |
| 9 | Number of research programs to develop more effective environmental/natural resources management systems. |
| 10 | Number of adult participants with increased knowledge of family resource management. |
| 11 | Number of research programs that study the function of nutrients and other components related to human health. |
| 12 | Number of youth that change in their ability to respond to one's own social-emotional needs and the social-emotional needs of others |
| 13 | Number of youth participants that increase knowledge in financial literacy and money management. |
| 14 | Number of adult participants with increased knowledge in home ownership education and foreclosure counseling. |

Outcome # 1

1. Outcome Target

Number of research programs to determine the relationship between family meals/lifestyle factors, education/food choices, general health and environmental influences, physical activity and general health.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 703 - Nutrition Education and Behavior
- 802 - Human Development and Family Well-Being
- 724 - Healthy Lifestyle
- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

Number of research programs to understand how environmental pollutants, especially ozone and endocrine disruptors, affect human health.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 723 - Hazards to Human Health and Safety
- 805 - Community Institutions and Social Services

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Number of research programs to develop better models for the human health and human services sector.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 802 - Human Development and Family Well-Being
- 805 - Community Institutions and Social Services
- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 4

1. Outcome Target

Number of adult participants with increased knowledge about healthy lifestyles.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 724 - Healthy Lifestyle

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 5

1. Outcome Target

Number of youth participants with increased knowledge about healthy lifestyles.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development
- 724 - Healthy Lifestyle

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 6

1. Outcome Target

Number of adult participants with increased knowledge of human development and family well-being.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 802 - Human Development and Family Well-Being

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 7

1. Outcome Target

Number of youth participants with increased knowledge of life skills.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 802 - Human Development and Family Well-Being
- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 8

1. Outcome Target

Number of adult participants with increased knowledge of youth development.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development
- 802 - Human Development and Family Well-Being

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 9

1. Outcome Target

Number of research programs to develop more effective environmental/natural resources management systems.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 723 - Hazards to Human Health and Safety
- 608 - Community Resource Planning and Development

4. Associated Institute Type(s)

- 1862 Research

Outcome # 10

1. Outcome Target

Number of adult participants with increased knowledge of family resource management.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 801 - Individual and Family Resource Management

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 11

1. Outcome Target

Number of research programs that study the function of nutrients and other components related to human health.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 702 - Requirements and Function of Nutrients and Other Food Components
- 723 - Hazards to Human Health and Safety

4. Associated Institute Type(s)

- 1862 Research

Outcome # 12

1. Outcome Target

Number of youth that change in their ability to respond to one's own social-emotional needs and the social-emotional needs of others

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development
- 802 - Human Development and Family Well-Being
- 724 - Healthy Lifestyle

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 13

1. Outcome Target

Number of youth participants that increase knowledge in financial literacy and money management.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development
- 801 - Individual and Family Resource Management

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 14

1. Outcome Target

Number of adult participants with increased knowledge in home ownership education and foreclosure counseling.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 801 - Individual and Family Resource Management

4. Associated Institute Type(s)

- 1862 Extension

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Description

A drastic change in population could necessitate a change in priorities to meet the needs of the target audiences. Further, the ongoing challenges faced with Michigan's overall economy has resulted in significant cuts to higher education -- including research and extension activities -- and additional cuts and appropriation changes are expected to continue over the next several years, including the federal sequestration process. The current economic environment is also intensifying competing public priorities and programmatic challenges. Reduction in funding resources could also affect/delay progress and outcomes.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

As Hatch dollars are base funding for faculty salaries, there is a built-in evaluation mechanism through annual reviews of overall performance, research productivity and the leveraging of additional research dollars. In addition, many of the research projects have an evaluative element that is required by state and federal-level funding sources that provides documentation related to project assumptions, goals and outcomes. This information is used to determine the overall success of the research initiatives; their contribution to providing practical, real-world solutions and resources to address challenges and problems; and whether continuation funding and/or new dollars are appropriate and necessary as funds are available.

Extension -- Evaluations of Extension activities are done regularly using a variety of approaches. To determine whether knowledge/behavior has changed, we will assess participants. To determine whether the environment/human health has improved, we will use agreed-upon parameters to evaluate any benefits/risks. Extension also uses pre- and post-program surveys to determine the change in competency level of participants in educational programs.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Soil, Water and Natural Resources

2. Brief summary about Planned Program

Michigan has more than 36 million acres of land with more than 11,000 inland lakes and 36,000 miles of streams. No place in Michigan is more than 85 miles from one of the Great Lakes. The state's land and water support the plants and animals that provide shelter, food and fiber. They provide minerals and other inorganic materials and are the final repository for all the state's waste. Agriculture and natural resources industries -- the two most economically important industries in Michigan after the automobile industry -- depend completely on the state's soil and water resources to remain viable.

To preserve, protect and enhance these resources, MSU AgBioResearch and MSU Extension have extensive research and education programs addressing specific Michigan needs. Soil conservation, waste management and use of waste products, ecosystem management, water research (quality, watershed management, and water use for agriculture and natural resources businesses) are all areas of focus that have been identified as important by stakeholders.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|---|-----------------|-----------------|----------------|----------------|
| 101 | Appraisal of Soil Resources | 1% | | 5% | |
| 102 | Soil, Plant, Water, Nutrient Relationships | 19% | | 12% | |
| 111 | Conservation and Efficient Use of Water | 12% | | 12% | |
| 112 | Watershed Protection and Management | 15% | | 10% | |
| 123 | Management and Sustainability of Forest Resources | 8% | | 5% | |
| 131 | Alternative Uses of Land | 18% | | 6% | |
| 132 | Weather and Climate | 1% | | 10% | |
| 133 | Pollution Prevention and Mitigation | 12% | | 12% | |
| 134 | Outdoor Recreation | 1% | | 1% | |
| 135 | Aquatic and Terrestrial Wildlife | 5% | | 12% | |
| 216 | Integrated Pest Management Systems | 0% | | 15% | |
| 806 | Youth Development | 8% | | 0% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Michigan is a state defined, literally, by water. Without the Great Lakes, Michigan's peninsulas would not exist. Nor would much of the state's agriculture, manufacturing, shipping and tourism offerings. Water is necessary for life -- every human needs water to live, as do the plants and animals that provide food and shelter. Michigan has more households -- 1.12 million -- served by private wells than any other state.

At the same time, Michigan's land resources provide food, shelter and space and materials for the state's industries, as well as recreation.

Research and education are needed to:

- Identify the trends, causes, and consequences of urban sprawl and to provide recommendations to state government to minimize the negative effects of current land use patterns on Michigan's environment and economy.
- Determine the best way to remove pollutants from soil and water and turn over these areas into safe, productive sites.
- Provide farmers with techniques to maintain the health and productivity of their soils.
- Offer growers a more thorough understanding of the relationships among crops, nutrients and water and how crops can be grown efficiently and productively with the fewest inputs possible.
- 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.
- Develop tools and technology to help Michigan's natural resources-based tourism industry grow by meeting consumer demands.
- Determine how wildlife, fisheries, and natural resources areas respond to habitat management to encourage management for sustainable benefits.

These priorities have been identified as important by Michigan citizens, farmers, state government representatives, private industry and commodity groups.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The assumptions made for this planned program are:

- Determining the causes of undesirable outcomes will lead to techniques to change the undesirable outcome into a desirable outcome.
- Developing best practices to remove pollutants will lead to safe, healthy soil and water resources. Farmers depend on their land for their livelihoods. They want to ensure that it is sustainable and productive. All Michigan citizens should have access to clean land and water. Two of Michigan's top industries (agriculture and tourism) depend on the availability of clean land and water.
- Farmers will adopt new production methods if the methods are proven to work and will enhance the farmers' profitability.
- Sustainable forests, land and water benefit Michigan's economy and quality of life.
- Funding will remain constant or decrease.

2. Ultimate goal(s) of this Program

The ultimate goals for this planned program are to:

- Identify the trends, causes, and consequences of urban sprawl and provide recommendations to state government to minimize the negative effects of current land use patterns on Michigan's environment and economy.
- Determine the best way to remove pollutants from soil and water and turn over these areas into safe, productive sites.
- Provide farmers with techniques to maintain the health and productivity of their soils.
- Offer growers a more thorough understanding of the relationships among crops, nutrients and water and how crops can be grown efficiently and productively with the fewest inputs possible.
- 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.
- Develop tools and technology to help Michigan's natural resources-based tourism industry grow by meeting consumer demands.

- Determine how wildlife, fisheries, and natural resources areas respond to habitat management to encourage management for sustainable benefits.
- Foster positive resource management attitudes and stewardship actions.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

| Year | Extension | | Research | |
|------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| 2017 | 15.2 | 0.0 | 11.5 | 0.0 |
| 2018 | 14.8 | 0.0 | 11.5 | 0.0 |
| 2019 | 14.4 | 0.0 | 12.0 | 0.0 |
| 2020 | 14.0 | 0.0 | 11.5 | 0.0 |
| 2021 | 14.0 | 0.0 | 11.5 | 0.0 |

V(F). Planned Program (Activity)

1. Activity for the Program

Research programs and Extension activities to:

- Develop new land use models for Michigan communities.
- Offer education to planners, elected officials and citizens on how these new models will reduce sprawl and ensure that the desirable outcomes will become reality.
 - Create new remediation strategies to clean up polluted soil and water. These strategies will be environmentally friendly, economically feasible and easy to implement with proper training.
 - Discover new knowledge about the composition, organization and fluctuations of microbial populations in the soils.
 - Develop a user-friendly computer program for nutrient management for Michigan crop and livestock producers to improve the management of fertilizer and manure nutrients on cropland to protect water resources and boost crop productivity.
 - Develop management techniques for potato and vegetable growers that includes cover crops.
 - Develop new nitrogen application recommendations for turf managers.
 - Develop a management system for Michigan inland lakes that does not involve sampling the lakes.
 - Develop Total Maximum Daily Load (TMDL) assessment tools for evaluation of Michigan watersheds.
- Determine how wildlife responds to ecosystem management decisions in forest and agricultural systems
 - Develop fish population/community computer models for species important to Michigan. These models will be used to evaluate different fishery management strategies.
 - Develop web-based tools and models for natural resources managers so knowledge can be shared quickly and easily.
 - Develop computer models to assess how habitat management affects species important to Michigan, including white-tailed deer, salmon, trout and perch.
 - Promote and support value-added processing of forest products, including wood products, biofuels, maple syrup and other nontimber products.
 - Identify, prevent and control exotic invasive pests and diseases of forests.

- Conduct educational programs to help farmers improve nutrient management and other practices to maintain and improve quality of groundwater and surface water.
- Conduct educational programs with riparians and lake users to enhance their understanding of watershed management and inland lakes water quality issues.
- Work with state agencies and local communities to encourage protection of community groundwater supplies through wellhead protection programs.
- Educate and train health officials, consultants, engineers and riparians to improve onsite and decentralized wastewater treatment and design.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

| Direct Methods | Indirect Methods |
|--|--|
| <ul style="list-style-type: none"> • Education Class • Workshop • Group Discussion • One-on-One Intervention • Demonstrations | <ul style="list-style-type: none"> • Public Service Announcement • Newsletters • TV Media Programs • Web sites other than eXtension • Other 1 (News Releases) • Other 2 (Annual Report/Magazine) |

3. Description of targeted audience

Michigan farmers, natural resource managers, private citizens, agriculture and natural resources industry representatives, state agencies, riparians and foresters.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of research programs on soil, water and natural resources.
 - Number of adult participants trained in soil, plant, water and nutrient relationships.
 - Number of adult participants trained in how human activities impact on ecosystems.
 - Number of youth participants trained in how human activities impact on ecosystems.
- Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

| O. No | Outcome Name |
|-------|---|
| 1 | Number of research programs to discover new knowledge about the composition, organization and fluctuations of microbial populations in the soils. |
| 2 | Number of adult participants with increased knowledge of how human activities impact ecosystem. |
| 3 | Number of research programs to determine how wildlife responds to ecosystem management decisions in natural resource and agricultural systems. |
| 4 | Number of adult participants with increased knowledge of soil, plant, water and nutrient relationships. |
| 5 | Number of research programs that deal with fish population dynamics and the management of Great Lakes fisheries. |
| 6 | Number of research programs that deal with the security, stewardship and management of Michigan's water resources. |
| 7 | Number of research programs that analyze key soil characteristics to better assess their agricultural and environmental contribution, including crop yield. |
| 8 | Number of research programs that explore the occurrence, transport and fate/effect of organic contaminants, chemicals, pesticides, pharmaceuticals and particulates in soils. |
| 9 | Number of research programs to develop new land use models for Michigan communities. |

Outcome # 1

1. Outcome Target

Number of research programs to discover new knowledge about the composition, organization and fluctuations of microbial populations in the soils.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 101 - Appraisal of Soil Resources
- 102 - Soil, Plant, Water, Nutrient Relationships

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

Number of adult participants with increased knowledge of how human activities impact ecosystem.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 131 - Alternative Uses of Land
- 123 - Management and Sustainability of Forest Resources
- 112 - Watershed Protection and Management
- 132 - Weather and Climate

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 3

1. Outcome Target

Number of research programs to determine how wildlife responds to ecosystem management decisions in natural resource and agricultural systems.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 135 - Aquatic and Terrestrial Wildlife

- 123 - Management and Sustainability of Forest Resources

4. Associated Institute Type(s)

- 1862 Research

Outcome # 4

1. Outcome Target

Number of adult participants with increased knowledge of soil, plant, water and nutrient relationships.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 5

1. Outcome Target

Number of research programs that deal with fish population dynamics and the management of Great Lakes fisheries.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 134 - Outdoor Recreation
- 112 - Watershed Protection and Management
- 135 - Aquatic and Terrestrial Wildlife

4. Associated Institute Type(s)

- 1862 Research

Outcome # 6

1. Outcome Target

Number of research programs that deal with the security, stewardship and management of Michigan's water resources.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 133 - Pollution Prevention and Mitigation
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management

4. Associated Institute Type(s)

- 1862 Research

Outcome # 7

1. Outcome Target

Number of research programs that analyze key soil characteristics to better assess their agricultural and environmental contribution, including crop yield.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 102 - Soil, Plant, Water, Nutrient Relationships
- 101 - Appraisal of Soil Resources
- 111 - Conservation and Efficient Use of Water

4. Associated Institute Type(s)

- 1862 Research

Outcome # 8

1. Outcome Target

Number of research programs that explore the occurrence, transport and fate/effect of organic contaminants, chemicals, pesticides, pharmaceuticals and particulates in soils.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 216 - Integrated Pest Management Systems
- 132 - Weather and Climate
- 101 - Appraisal of Soil Resources

- 133 - Pollution Prevention and Mitigation
- 112 - Watershed Protection and Management
- 111 - Conservation and Efficient Use of Water
- 102 - Soil, Plant, Water, Nutrient Relationships

4. Associated Institute Type(s)

- 1862 Research

Outcome # 9

1. Outcome Target

Number of research programs to develop new land use models for Michigan communities.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 112 - Watershed Protection and Management
- 102 - Soil, Plant, Water, Nutrient Relationships
- 135 - Aquatic and Terrestrial Wildlife
- 131 - Alternative Uses of Land
- 123 - Management and Sustainability of Forest Resources

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Description

Michigan's soil, water and other natural resources are all in a delicate balance. If one part of the equation changes, through a new public policy, funding allocation change or a drought or other extreme weather event, it will affect all the other natural resources in the state.

Further, the ongoing challenges that face Michigan's overall economy has resulted in significant cuts to higher education -- including research and extension activities -- and additional cuts and appropriation changes are expected to continue over the next several years, including the effects of the federal sequestration process. The current economic environment is also intensifying competing public priorities and programmatic challenges. Reduction in funding resources could also affect/delay progress and outcomes.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Research

As Hatch dollars are base funding for faculty salaries, there is a built-in evaluation mechanism through annual reviews of overall performance, research productivity and the leveraging of additional research dollars. In addition, many of the research projects have an evaluative element that is required by state and federal-level funding sources that provides documentation related to project assumptions, goals and outcomes. This information is used to determine the overall success of the research initiatives; their contribution to providing practical, real-world solutions and resources to address challenges and problems; and whether continuation funding and/or new dollars are appropriate and necessary as funds are available.

Extension -- Evaluations of Extension activities are done regularly using a variety of approaches. To determine whether knowledge/behavior has changed, we will assess participants. To determine whether the environment/human health has improved, we will use agreed-upon parameters to evaluate any benefits/risks. Extension also uses pre- and post-program surveys to determine the change in competency level of participants in educational programs.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Plant Sciences

2. Brief summary about Planned Program

Michigan produces more than 200 commodities, making the state second only to California in terms of crop diversity. Michigan growers continue to need new varieties, cultural techniques and pest management strategies whether they are growing corn, apples, cherries, blueberries, turfgrass, petunias, or ornamental crabapple trees.

Michigan is one of the country's top producers of specialty crops. Because the acreage of these crops is lesser than that of corn, wheat, rice and soybeans, it isn't economically attractive for chemical companies to make developing pesticides for them a priority. So the state's growers of these smaller-acreage commodities look to MSU AgBioResearch (formerly the Michigan Agricultural Experiment Station) and MSU Extension to provide the research and education on pesticides and management techniques.

Since 1915, Michigan State University plant breeders have released more than 300 varieties of plants, from corn, wheat and alfalfa to zinnias, strawberries and spruce trees. Each breeder works closely with Michigan growers to improve the desirable traits in each crop while keeping yields high. At the same time, AgBioResearch scientists and MSUE educators work continuously with growers to develop and test new management techniques to provide protection from insects, weeds, diseases and undesirable weather. As the demand for organic food increases, researchers and educators work to provide producers with cultural and pest management techniques that meet USDA organic standards.

MSU Extension proposes to create a new Federally-Recognized Tribes Extension Program (FRTEP) servicing four federally-recognized tribes in the Eastern Upper Peninsula and Northern Lower Peninsula of Michigan. The proposed program will represent the first FRTEP servicing any tribal government in the Northeastern United States. The tribes partnering on the project are the Bay Mills Indian Community, the Hannahville Indian Community, the Little Traverse Bay Bands of Odawa Indians and the Sault Ste. Marie Tribe of Chippewa Indians. The project seeks to improve the health, well-being, energy independence and financial independence of these four Michigan Indian tribes through the creation of two full-time Extension educator positions that will assist the tribes in advancing their agricultural and renewable resource programs. Agricultural and horticultural program activities will focus on enhancing the production and profitability of small-scale tribal agriculture projects and improving tribal member wellness. Renewable resource and sustainable development program activities will use educational processes to facilitate the incorporation of renewable energies into tribal households, tribal governmental offices and tribal businesses and increase tribal capacity to develop forest and agricultural-based renewable resources in ecologically and economically sustainable ways.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|----------------|---|------------------------|------------------------|-----------------------|-----------------------|
| 201 | Plant Genome, Genetics, and Genetic Mechanisms | 5% | | 17% | |
| 202 | Plant Genetic Resources | 6% | | 5% | |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants | 7% | | 9% | |
| 204 | Plant Product Quality and Utility (Preharvest) | 5% | | 5% | |
| 205 | Plant Management Systems | 30% | | 10% | |
| 206 | Basic Plant Biology | 3% | | 10% | |
| 211 | Insects, Mites, and Other Arthropods Affecting Plants | 3% | | 13% | |
| 212 | Diseases and Nematodes Affecting Plants | 15% | | 11% | |
| 215 | Biological Control of Pests Affecting Plants | 3% | | 5% | |
| 216 | Integrated Pest Management Systems | 20% | | 15% | |
| 806 | Youth Development | 3% | | 0% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Michigan growers continue to need new varieties, cultural techniques and pest management strategies to remain competitive and thrive in a global economy. AgBioResearch scientists and MSU Extension educators aim to meet the following priorities:

- Develop new varieties that meet Michigan growers' needs (this includes fruit, vegetable, forestry, horticulture and field crop varieties).
- Identify and isolate novel genes, markers and genetic pathways that can benefit crops important to Michigan agriculture through higher yields, improved quality, better insect and disease resistance and greater tolerance to environmental stresses.
- Identify and isolate novel genes, enzymes and other phytochemicals that may benefit human health and determine how these beneficial compounds can be made available to people.
- Develop cultural, management and insect and disease control strategies for crops that meet USDA certified organic standards so Michigan growers can take advantage of this growing market, if they choose to do so.
- Develop biological controls for pest insects and diseases to minimize effects on the environment.
- Develop integrated management systems for Michigan crops that recognize that what is done in one area, say control aphids on soybeans, has an affect on the whole farm environment, including soil, air, water, and beneficial insects and microbes.
- Evaluate new crop varieties and make the results widely available so growers have the most up-to-

date information before planting.

- Develop a deeper understanding of the role specific genes and mutations play in crop quality, insect and disease resistance and environmental stress tolerance.
- Determine whether genes that impart desirable characteristics can safely and efficiently be incorporated into other species.
- Programs for underserved ethnic and racial groups - IPM scouts for Hispanic farmers & farm workers.
- Build tribal capacity in the area of small scale sustainable agriculture.

These priorities have been identified as important by Michigan citizens, farmers, state government representatives, private industry and commodity groups.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The assumptions made for this planned program are:

- New varieties will keep Michigan growers competitive and thriving in a global agricultural economy.
- Developing a deeper understanding of the genetic and metabolic processes in plants will allow the creation of higher-yielding, higher-quality plants with improved resistance to pests, diseases and environmental stress.
- Unlocking the genetic secrets of plants also will allow scientists to identify and isolate plant compounds that may benefit human health.
- New techniques to manufacture and dispense these beneficial compounds and vaccines may result.
- Integrated management and cultural practices will ensure that agriculture is sustainable and productive because fertile soil, water and air will continue to be available to support it.
- Integrated management strategies also ensure that the environment will be a safe and secure place to support human, animal and plant life.
- Funding will remain constant or decrease.

2. Ultimate goal(s) of this Program

The ultimate goals of this planned program are to:

- Develop improved varieties of dry beans, tart and sweet cherries, potatoes, wheat, rice, soybeans, oats, barley, canola, turfgrass, apples, strawberries, blueberries, floriculture crops, chestnuts, vegetable crops, and conifers for Michigan growers.
- Continue to identify genes and genetic pathways that control plant response to environmental stresses and develop techniques to insert these pathways into at-risk plants.
- Identify and isolate novel genes, markers and genetic pathways that can benefit crops important to Michigan agriculture through higher yields, improved quality, and better insect and disease resistance.
- Identify and isolate novel genes, enzymes and other phytochemicals that may have benefits for human health and determine how these beneficial compounds can be made available to people.
- Develop integrated management strategies and educational programs for fruit, field, vegetable, floriculture, Christmas tree and forestry crops that maximize the efficiency of resource inputs and improve

yield and quality, while minimizing environmental effects, such as leaching and run-off.

- Develop cultural, management and insect and disease control strategies for crops that meet USDA certified organic standards so Michigan growers can take advantage of this growing market, if they choose to do so.
- Continue to develop biological controls for pest insects and diseases to minimize any effects on the environment.
- Provide green industry professionals and homeowners with scientifically sound information to enable them to safely and effectively manage their turf, landscapes and gardens, improving efficiency of resources and controlling pests, while reducing pesticide and fertilizer use.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

| Year | Extension | | Research | |
|------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| 2017 | 28.9 | 0.0 | 20.0 | 0.0 |
| 2018 | 28.1 | 0.0 | 20.0 | 0.0 |
| 2019 | 27.4 | 0.0 | 21.0 | 0.0 |
| 2020 | 26.6 | 0.0 | 20.0 | 0.0 |
| 2021 | 26.6 | 0.0 | 20.0 | 0.0 |

V(F). Planned Program (Activity)

1. Activity for the Program

Research programs to:

- Develop improved varieties of dry beans, tart and sweet cherries, potatoes, wheat, rice, soybeans, oats, barley, canola, turfgrass, apples, strawberries, blueberries, floriculture crops, chestnuts, vegetable crops, and conifers for Michigan growers.
- Continue to identify genes and genetic pathways that control plant response to environmental stresses and develop techniques to insert these pathways into at-risk plants.
- Identify and isolate novel genes, markers and genetic pathways that can benefit crops important to Michigan agriculture through higher yields, improved quality, and better insect and disease resistance.
- Identify and isolate novel genes, enzymes and other phytochemicals that may have benefits for human health and determine how these beneficial compounds can be made available to people.
- Develop integrated management strategies and provide education programs for producers of fruit, field, vegetable, floriculture, Christmas tree and forestry crops that use the lowest possible inputs of resources and improve yield and quality, while minimizing environmental effects, such as leaching and run-off.
- Develop cultural, management and insect and disease control strategies for crops that meet USDA certified organic standards so Michigan growers can take advantage of this growing market, if they choose to do so.
- Continue to develop biological controls for pest insects and diseases to minimize effects on the environment.
- Continue variety trials for crops important to Michigan, including wheat, corn, soybeans and forages.

Extension activities to:

- Conduct educational programs to help farm producers control weeds and more effectively manage high-cost fertilizer inputs while optimizing crop production.
- Develop plant disease prediction models.
- Conduct educational programs to help plant producers control disease caused by pathogens and nematodes and teach integrated pest management methods.
- Provide green industry professionals and homeowners with scientifically sound information to enable them to safely and effectively manage their turf, landscapes and gardens, improving efficiency of resources and controlling pests, while reducing pesticide and fertilizer use.
- Train Native American adults in sustainable agriculture.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

| Direct Methods | Indirect Methods |
|--|---|
| <ul style="list-style-type: none"> • Education Class • Workshop • Group Discussion • One-on-One Intervention • Demonstrations | <ul style="list-style-type: none"> • Newsletters • TV Media Programs • Web sites other than eXtension • Other 1 (News Releases) • Other 2 (Annual Report/Publications) |

3. Description of targeted audience

Michigan growers (traditional and organic), commodity groups, agriculture and natural resources industry representatives (including herbicide, pesticide and insecticide suppliers), green industry/landscape/turf professionals, state agricultural agencies, Native American growers and the interested public.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of research projects on plant sciences.
 - Number of adult participants trained in plant management systems.
 - Number of youth participants trained in plant management systems.
 - Number of adult participants trained in integrated pest management (IPM).
- Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

| O. No | Outcome Name |
|-------|---|
| 1 | Number of adult participants with increased knowledge of integrated pest management (IPM). |
| 2 | Number of research programs to develop insect and disease control and/or cultural and management strategies for organic crops. |
| 3 | Number of research programs to develop biological controls for pest insects and diseases to minimize any effects on the environment. |
| 4 | Number of research programs to develop integrated management strategies for fruit, field, vegetable, floriculture and forestry crops that use the lowest amounts of nutrients possible and improve yield and quality. |
| 5 | Number of research programs to identify and isolate novel genes, markers and genetic pathways that can benefit crops important to Michigan agriculture through higher yields, improved quality, and better insect and disease resistance. |
| 6 | Number of research programs to identify genes and genetic pathways that control plant response to environmental stresses and develop techniques to insert these pathways into at-risk plants. |
| 7 | Number of research programs to develop improved varieties of economically important crops for Michigan and the region. |
| 8 | Number of adult participants with increased knowledge of plant management systems. |
| 9 | Number of research programs to develop weed control methodologies, protocols and practices. |
| 10 | Number of research programs to develop controls for pathogens and nematodes affecting plants. |
| 11 | Number of research programs to develop production protocols and environmental and cultural strategies for the floriculture/nursery industry. |

Outcome # 1

1. Outcome Target

Number of adult participants with increased knowledge of integrated pest management (IPM).

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 216 - Integrated Pest Management Systems

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 2

1. Outcome Target

Number of research programs to develop insect and disease control and/or cultural and management strategies for organic crops.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 216 - Integrated Pest Management Systems
- 215 - Biological Control of Pests Affecting Plants
- 205 - Plant Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Diseases and Nematodes Affecting Plants

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

Number of research programs to develop biological controls for pest insects and diseases to minimize any effects on the environment.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 216 - Integrated Pest Management Systems
- 215 - Biological Control of Pests Affecting Plants
- 212 - Diseases and Nematodes Affecting Plants
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 4

1. Outcome Target

Number of research programs to develop integrated management strategies for fruit, field, vegetable, floriculture and forestry crops that use the lowest amounts of nutrients possible and improve yield and quality.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 204 - Plant Product Quality and Utility (Preharvest)
- 206 - Basic Plant Biology
- 205 - Plant Management Systems
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 5

1. Outcome Target

Number of research programs to identify and isolate novel genes, markers and genetic pathways that can benefit crops important to Michigan agriculture through higher yields, improved quality, and better insect and disease resistance.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 201 - Plant Genome, Genetics, and Genetic Mechanisms

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 206 - Basic Plant Biology
- 202 - Plant Genetic Resources

4. Associated Institute Type(s)

- 1862 Research

Outcome # 6

1. Outcome Target

Number of research programs to identify genes and genetic pathways that control plant response to environmental stresses and develop techniques to insert these pathways into at-risk plants.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 216 - Integrated Pest Management Systems
- 202 - Plant Genetic Resources
- 206 - Basic Plant Biology
- 201 - Plant Genome, Genetics, and Genetic Mechanisms

4. Associated Institute Type(s)

- 1862 Research

Outcome # 7

1. Outcome Target

Number of research programs to develop improved varieties of economically important crops for Michigan and the region.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)

4. Associated Institute Type(s)

- 1862 Research

Outcome # 8

1. Outcome Target

Number of adult participants with increased knowledge of plant management systems.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 9

1. Outcome Target

Number of research programs to develop weed control methodologies, protocols and practices.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 216 - Integrated Pest Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 10

1. Outcome Target

Number of research programs to develop controls for pathogens and nematodes affecting plants.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 212 - Diseases and Nematodes Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 206 - Basic Plant Biology
- 205 - Plant Management Systems
- 216 - Integrated Pest Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 11

1. Outcome Target

Number of research programs to develop production protocols and environmental and cultural strategies for the floriculture/nursery industry.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Description

Public reaction to biotechnology affects the breeding and plant genetic work of AgBioResearch scientists. In order to meet grower demands and satisfy the public's demand for safe food, breeders must use a variety of technologies. Also, weather plays a large role in the prevalence of weeds, pest insects and diseases. New priorities may emerge as the environment changes.

During the 2013-2014 fiscal year, ABR and MSUE was able to start rebuilding some of its resources after several years of either flat or funding cuts at both the state and federal levels. ABR was able to **fill voids in its research and support teams by hiring quality, skilled people for a variety of positions ranging from farm managers and grant coordinators to faculty and research technicians. Much needed equipment and infrastructure updates were also conducted at many on-campus and outlying research facilities**, helping to keep operations to full capacity. In 2014, ABR and Project GREEN funds helped bridge operating budget gaps at five of the 13 outlying research centers, enabling the repairs of equipment and several buildings. Together, the organizations look to re-invigorate the MSUE presence at the 13 outlying research centers throughout the state.

The **ongoing economic challenges** faced by Michigan continue to affect this planned program area. Consequences have included fewer new hires, delaying the award of new financial obligations, reducing levels of continued funding, and renegotiating or reducing the current scope of assistance through formula funds or block grants. Specifically, a 15 percent decrease in state funding FY2011-2012 coupled with a flat federal funding line for the following two years resulted in the elimination of 72 Extension educator positions across 83 counties, 22 academic and faculty positions on campus and 15 support staff. Administrative positions were reduced from 45 to 19 FTEs. Impacts on ABR came largely in the form of reductions in research infrastructure support. Investments in facility maintenance and equipment were postponed in an effort to avoid eliminating more than 45 research positions (faculty, support staff and graduate assistants) and one research facility had to be closed in light of the reductions. There were also fewer funds to seed research on emerging issues.

Recent **extreme weather events** also caused extensive hardship to the agriculture industry. The spring 2012 ranks among the most destructive weather periods in Michigan fruit production history, with crop losses valued at more than \$500 million. Peach production suffered a 95 percent loss; tart cherry, a 90 percent crop loss; apple production, an 88 percent loss; and grapes, an 85 percent loss. The summer 2012 brought the worst drought in Michigan since 1988 with many crops suffering substantial losses. And the winter of 2013-14 brought a series of bitterly cold air masses rolled down from the Arctic, through Canada and into Michigan. The period between November 2013 and February 2014 was the coldest in Michigan since 1911 and among the five coldest periods on record in the state.

Together, MSUE and ABR continue to serve as the primary research and development arm for the agriculture and food industries in Michigan, valued at more than \$100 billion annually.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Research -

As Hatch dollars are base funding for faculty salaries, there is a built-in evaluation mechanism through annual reviews of overall performance, research productivity and the leveraging of additional research dollars. In addition, many of the research projects have an evaluative element that is required by state and federal-level funding sources that provides documentation related to project assumptions, goals and outcomes. This information is used to determine the overall success of the research initiatives; their contribution to providing practical, real-world solutions and resources to address challenges and problems; and whether continuation funding and/or new dollars are appropriate and necessary as funds are available.

Extension -- The research and education will be evaluated in a variety of ways. To determine whether knowledge/behavior has changed, we will query participants. To determine if new management strategies have benefited growers and the environment, we will survey growers as well as independently sample environmental parameters. New varieties will be evaluated by yield, pest and environmental stress resistance and grower adoption.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Economics, Marketing and Policy

2. Brief summary about Planned Program

All Michigan 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. The most perfect product in the world won't be deemed successful unless it gets into the hands of consumers who desire it.

Surrounded by the Great Lakes, Michigan also plays a key role in domestic and international shipping. Michigan exports about one-third of its agricultural commodities each year.

Research and education on international trade and development, economic policy, domestic and foreign policy, and community resource planning and development will help Michigan growers and producers navigate governmental regulations both here and abroad, as well as connect them with foreign buyers and markets.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|----------------|--|------------------------|------------------------|-----------------------|-----------------------|
| 601 | Economics of Agricultural Production and Farm Management | 20% | | 12% | |
| 602 | Business Management, Finance, and Taxation | 12% | | 10% | |
| 603 | Market Economics | 3% | | 8% | |
| 604 | Marketing and Distribution Practices | 5% | | 9% | |
| 605 | Natural Resource and Environmental Economics | 15% | | 14% | |
| 606 | International Trade and Development Economics | 3% | | 11% | |
| 608 | Community Resource Planning and Development | 26% | | 10% | |
| 609 | Economic Theory and Methods | 3% | | 12% | |
| 610 | Domestic Policy Analysis | 5% | | 9% | |
| 611 | Foreign Policy and Programs | 1% | | 5% | |
| 806 | Youth Development | 7% | | 0% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Agriculture production in Michigan has always been a business of narrow margins. Spring freezes, fluctuating prices and demand, drought, diseases and insects, production costs, land prices, development, and the availability of farm labor coupled with public policy changes make more than getting by a challenge under the best of conditions. Michigan's growers, consumers and agencies have identified the following priorities:

- Identify current and emerging key public policy issues on trade, environmental, agricultural and food issues important to Michigan and analyze responses.
- Conduct research and education to improve the operations, business and financial management skills of Michigan producers so they can make decisions that are more sound financially and environmentally.
- Evaluate the competitiveness and marketing strategies of Michigan farm markets, greenhouses and other green industry retailers.
- Identify and evaluate human resources management practices in Michigan agricultural and green industries.
- Develop a framework to understand and analyze domestic and international trade policies and assess their impact on Michigan.
- Determine rationale for farmland preservation choices and how changes will affect the Michigan tax base.

- Develop models to estimate the demand for and value of recreational fisheries and wildlife resources.
- Identify and evaluate the policy, technology and marketing issues faced by Michigan organic growers and develop responses. Market data show that citizens prefer small, mixed-use communities in which they can meet their basic needs within a five-minute walk.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The assumptions made for this planned program are:

- Research on economics, management, policy and marketing will keep Michigan producers' operations growing and profitable.
- Meeting producer needs will also ensure that Michigan citizens have access to a plentiful, secure, high-quality food supply and a clean, sustainable environment.
- Funding will remain constant or decrease.

2. Ultimate goal(s) of this Program

The ultimate goals of this planned program are to:

- Enhance the profitability of Michigan agriculture and natural resources industries.
- Enhance rural and urban community development.
- Identify current and emerging key public policies addressing trade, environmental, agricultural and food issues of particular import to policymakers, taxpayers, consumers and business persons.
- Understand how food system conflicts can be transformed into opportunities for citizens to have a voice related to this area.
- Develop and implement effective youth smoking intervention programs that involve school tobacco programs. Provide Michigan citizens with a healthy environment and a secure, plentiful food supply; and help communities use planning and zoning effectively to meet community goals.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

| Year | Extension | | Research | |
|------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| 2017 | 27.9 | 0.0 | 6.5 | 0.0 |
| 2018 | 27.2 | 0.0 | 7.0 | 0.0 |
| 2019 | 26.5 | 0.0 | 7.0 | 0.0 |

| | | | | |
|------|------|-----|-----|-----|
| 2020 | 25.7 | 0.0 | 7.0 | 0.0 |
| 2021 | 25.7 | 0.0 | 7.0 | 0.0 |

V(F). Planned Program (Activity)

1. Activity for the Program

Research programs to:

- Identify current and emerging key public policy issues on trade, environmental, agricultural and food issues important to Michigan and analyze responses.
- Conduct research and education to improve the operations, business and financial management skills of Michigan producers so they can make decisions that are more sound financially and environmentally.
- Evaluate the competitiveness and marketing strategies of Michigan farm markets, greenhouses and other green industry retailers.
- Develop a framework to understand and analyze domestic and international trade policies and assess their impact on Michigan.
- Evaluate how Michigan citizens use the Internet when searching for information about a vacation destination or planning a vacation.
- Determine rationale for farmland preservation choices and how changes will affect the Michigan tax base.
- Develop models to estimate the demand for and value of recreational fisheries and wildlife resources.
- Identify and evaluate the policy, technology and marketing issues faced by Michigan organic growers and develop responses.

Extension program activities to:

- Teach financial management skills, business organization, estate planning, management information systems, strategic management, alternative sustainable production and marketing systems to agriculture and natural resources producers and businesses.
- Assist agencies, organizations, local governmental units and individuals in pursuing a cultural economic development strategy.
- Offer business retention and expansion support.
- Help people recognize, understand and appreciate multicultural differences.
- Provide entrepreneurship education to a broad audience, including individuals, business owners, youth and communities.
- Offer communities consultative, diagnostic and educational assistance in planning and zoning to meet community land use goals.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

| | |
|-----------------------|-------------------------|
| Direct Methods | Indirect Methods |
|-----------------------|-------------------------|

- | | |
|--|---|
| <ul style="list-style-type: none">● Education Class● Workshop● Group Discussion● One-on-One Intervention● Demonstrations | <ul style="list-style-type: none">● Newsletters● TV Media Programs● Web sites other than eXtension● Other 1 (News Releases)● Other 2 (Annual Report/Magazine) |
|--|---|

3. Description of targeted audience

Agriculture and natural resources producers and industry representatives; tourism industry representatives; state agency representatives; private citizens; school administrators; local, state and federal elected officials and policymakers.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of research programs on economics, marketing and policy.
- Number of adult participants trained in economics of agricultural production and farm management.
- Number of adult participants trained in business management and finance.
- Number of adult participants trained in community resource planning and development.
- Number of youth participants trained in entrepreneurship.

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

| O. No | Outcome Name |
|-------|---|
| 1 | Number of adult participants with increased knowledge in economics of agricultural production and farm management. |
| 2 | Number of adult participants with increased knowledge in business management, finance and taxation. |
| 3 | Number of adult participants with increased knowledge in community resource planning and development. |
| 4 | Number of research programs to identify current and emerging key public policy issues on trade, environmental, agricultural and food issues important to Michigan and analyze responses. |
| 5 | Number of research programs to improve the operations, business and financial management skills for Michigan producers so they can make decisions that are more sound financially and environmentally. |
| 6 | Number of research programs to evaluate the competitiveness and marketing strategies and human resources management practices of Michigan farm markets, greenhouses and other green industry retailers. |
| 7 | Number of research programs to develop a framework to understand and analyze domestic and international trade policies and assess their impact on Michigan. |
| 8 | Number of research programs to develop models to estimate the demand for and value of recreational fisheries and wildlife resources. |
| 9 | Number of youth with increased knowledge in entrepreneurship. |

Outcome # 1

1. Outcome Target

Number of adult participants with increased knowledge in economics of agricultural production and farm management.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 602 - Business Management, Finance, and Taxation
- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 2

1. Outcome Target

Number of adult participants with increased knowledge in business management, finance and taxation.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 602 - Business Management, Finance, and Taxation
- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 3

1. Outcome Target

Number of adult participants with increased knowledge in community resource planning and development.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 4

1. Outcome Target

Number of research programs to identify current and emerging key public policy issues on trade, environmental, agricultural and food issues important to Michigan and analyze responses.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development
- 601 - Economics of Agricultural Production and Farm Management
- 605 - Natural Resource and Environmental Economics
- 610 - Domestic Policy Analysis

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 5

1. Outcome Target

Number of research programs to improve the operations, business and financial management skills for Michigan producers so they can make decisions that are more sound financially and environmentally.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 604 - Marketing and Distribution Practices
- 602 - Business Management, Finance, and Taxation
- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 6

1. Outcome Target

Number of research programs to evaluate the competitiveness and marketing strategies and human resources management practices of Michigan farm markets, greenhouses and other green industry retailers.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development
- 609 - Economic Theory and Methods
- 603 - Market Economics
- 604 - Marketing and Distribution Practices
- 602 - Business Management, Finance, and Taxation

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 7

1. Outcome Target

Number of research programs to develop a framework to understand and analyze domestic and international trade policies and assess their impact on Michigan.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 605 - Natural Resource and Environmental Economics
- 606 - International Trade and Development Economics
- 611 - Foreign Policy and Programs
- 610 - Domestic Policy Analysis

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 8

1. Outcome Target

Number of research programs to develop models to estimate the demand for and value of recreational fisheries and wildlife resources.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 603 - Market Economics
- 605 - Natural Resource and Environmental Economics

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 9

1. Outcome Target

Number of youth with increased knowledge in entrepreneurship.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development
- 602 - Business Management, Finance, and Taxation

4. Associated Institute Type(s)

- 1862 Extension

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities

- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Description

Agricultural and natural resources markets and economies are affected by a variety of natural factors and public policy changes. Changes in population will affect farm labor.

The **ongoing economic challenges** faced by Michigan continue to affect this planned program area. Consequences have included fewer new hires, delaying the award of new financial obligations, reducing levels of continued funding, and renegotiating or reducing the current scope of assistance through formula funds or block grants. Specifically, a 15 percent decrease in state funding FY2011-2012 coupled with a flat federal funding line for the following two years resulted in the elimination of 72 Extension educator positions across 83 counties, 22 academic and faculty positions on campus and 15 support staff. Administrative positions were reduced from 45 to 19 FTEs. Impacts on ABR came largely in the form of reductions in research infrastructure support. Investments in facility maintenance and equipment were postponed in an effort to avoid eliminating more than 45 research positions (faculty, support staff and graduate assistants) and one research facility had to be closed in light of the reductions. There were also fewer funds to seed research on emerging issues.

Recent **extreme weather events** also caused extensive hardship to the agriculture industry. The spring 2012 ranks among the most destructive weather periods in Michigan fruit production history, with crop losses valued at more than \$500 million. Peach production suffered a 95 percent loss; tart cherry, a 90 percent crop loss; apple production, an 88 percent loss; and grapes, an 85 percent loss. The summer 2012 brought the worst drought in Michigan since 1988 with many crops suffering substantial losses. And the winter of 2013-14 brought a series of bitterly cold air masses rolled down from the Arctic, through Canada and into Michigan. The period between November 2013 and February 2014 was the coldest in Michigan since 1911 and among the five coldest periods on record in the state.

Together, MSUE and ABR continue to serve as the primary research and development arm for the agriculture and food industries in Michigan, valued at more than \$100 billion annually.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Research -

As Hatch dollars are base funding for faculty salaries, there is a built-in evaluation mechanism through annual reviews of overall performance, research productivity and the leveraging of additional research dollars. In addition, many of the research projects have an evaluative element that is required by state and federal-level funding sources that provides documentation related to project assumptions, goals and outcomes. This information is used to determine the overall success of the research initiatives; their contribution to providing practical, real-world solutions and resources to address challenges and problems; and whether continuation funding and/or new dollars are appropriate and necessary as funds are available.

Extension -- All research and education programs on policy, management and economics will be evaluated to see how well they work, as well as how many people adopt them and the changes that result.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Animal Production and Protection

2. Brief summary about Planned Program

Animal agriculture and its associated products -- milk, meat, wool, eggs, cheese and butter -- make up a significant portion of Michigan's economy. Besides food animals, Michigan also has prosperous horse racing, pleasure and sport riding industries.

Michigan Alliance for Animal Agriculture (M-AAA) is a new partnership between the MSU College of Agriculture and Natural Resources, ABR, MSUE and Michigan animal agriculture commodity organizations started in 2014 to advance animal agriculture. The Michigan food and agriculture system annually contributes about \$100 billion to the state's economy and provides nearly 1 million jobs. About 37 percent of the agricultural products sold are attributed to the animal agriculture sector. M-AAA focuses on advancing the state's animal agriculture economy by supporting applied research and outreach efforts that address key issues identified by the industry.

Enhancing profitability and quality in animal agriculture means research on new methods to combat diseases and parasites, as well as work on selecting animals with desirable traits and studies on nutrition and animal management systems. Because almost all animal production involves large up-front investments, research on improving animals' reproductive performance and reducing environmental stress is also critically important. The MSU Center for Animal Functional Genomics offers researchers the opportunity to use technology that allows them to track animals' response to stress from disease, giving birth, shipping and other environmental factors at the cellular and molecular levels. The center is allowing MSU researchers and educators to become national leaders in understanding immune system response at the genetic level in addition to other critical research efforts in animal production and protection.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|--|-----------------|-----------------|----------------|----------------|
| 301 | Reproductive Performance of Animals | 3% | | 10% | |
| 302 | Nutrient Utilization in Animals | 5% | | 13% | |
| 303 | Genetic Improvement of Animals | 2% | | 10% | |
| 304 | Animal Genome | 4% | | 10% | |
| 305 | Animal Physiological Processes | 5% | | 10% | |
| 307 | Animal Management Systems | 59% | | 13% | |
| 308 | Improved Animal Products (Before Harvest) | 1% | | 1% | |
| 311 | Animal Diseases | 10% | | 15% | |
| 314 | Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals | 4% | | 2% | |
| 315 | Animal Welfare/Well-Being and Protection | 3% | | 11% | |
| 605 | Natural Resource and Environmental Economics | 1% | | 5% | |
| 806 | Youth Development | 3% | | 0% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Michigan animal industries face different, and, one could argue, more numerous challenges than their crop-producing counterparts. While both groups have to deal with weather, insects and diseases, animal producers also have to worry about their animals' reproductive health and efficiency, nutrient management, feeding/milking schedules, as well as the stress of shipping, weaning, crowding and giving birth.

Michigan animal producers have identified several research and educational priorities for the coming years:

- Continue to develop and update the Michigan Agriculture Environmental Assurance Program guidelines and offer more education and outreach on the program.
- Develop new management strategies to increase profitability for animal producers.
- Develop tracking mechanism to quickly and accurately control populations when outbreaks of infectious diseases occur.
- Develop new systems and strategies to keep animals healthy and to identify and treat diseases before they spread through herds.
- Develop systems and strategies to ensure the welfare of animals from birth to rendering.
- Develop new technologies to identify animals with superior reproduction capability to increase

profitability.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The assumptions made for this planned program are:

- Research and education will help keep Michigan animal producers' operations profitable and growing, their animals healthy and their products high quality.
- Research on reproduction, nutrient utilization, genetics, environmental stresses, management systems, diseases and disease tracking, and animal welfare will meet these needs of producers, as well as ensure that Michigan residents have access to high-quality, plentiful animal products.
- Funding will remain constant or decrease.

2. Ultimate goal(s) of this Program

The ultimate goal of this planned program is:

- To provide new strategies and technologies to keep Michigan animal producers thriving and profitable, to provide a safe, high-quality supply of animal products to Michigan residents, and to ensure the humane treatment, health and well-being of animals.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

| Year | Extension | | Research | |
|------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| 2017 | 14.4 | 0.0 | 9.5 | 0.0 |
| 2018 | 14.1 | 0.0 | 9.0 | 0.0 |
| 2019 | 13.7 | 0.0 | 10.0 | 0.0 |
| 2020 | 13.3 | 0.0 | 9.0 | 0.0 |
| 2021 | 13.3 | 0.0 | 9.0 | 0.0 |

V(F). Planned Program (Activity)

1. Activity for the Program

Research programs to:

- Understand the processes that control/influence reproduction at the molecular and genetic level.
- Develop and test new cropping, grazing and feeding strategies for food animals.
- Develop and evaluate management/training strategies for race horses to reduce injuries.
- Add to the understanding of various food animal genomes by improving and integrating genetic maps.
- Understanding of the genetic and molecular processes that control/influence the immune system in food animals to create new disease detection and tracking technologies.
 - Develop and evaluate new tools and strategies to detect, prevent and control emerging and reemerging livestock and poultry diseases.
 - Understanding of the environmental fate and biological effects of vaccines, steroids and other drugs fed to animals.

Extension activities to:

- Assist beef producers with implementing the mandatory electronic identification system and demonstrate methods to use the system to sharpen management skills.
 - Provide livestock producers with knowledge and skills to develop and maintain herd-health systems.
 - Provide animal industry with up-to-date animal health information.
 - Improve farm-specific environmental stewardship related to manure management, including developing whole-farm nutrient management plans, manure value, land use and neighbor relations.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

| Direct Methods | Indirect Methods |
|--|--|
| <ul style="list-style-type: none"> • Education Class • Workshop • Group Discussion • One-on-One Intervention • Demonstrations | <ul style="list-style-type: none"> • Public Service Announcement • Newsletters • TV Media Programs • Web sites other than eXtension • Other 1 (News Releases) • Other 2 (Annual Report/Magazine) |

3. Description of targeted audience

Michigan animal producers, agriculture and natural resources industry representatives, animal pharmaceutical industry, animal welfare organizations, state agency representatives, state and local elected officials and the interested public.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
 - Number of patents submitted
 - Number of peer reviewed publications
- Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of research programs on animal production and protection.
 - Number of adult participants trained in animal management systems.
 - Number of youth participants trained in animal management systems.
- Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

| O. No | Outcome Name |
|-------|--|
| 1 | Number of adult participants with increased knowledge about animal management systems. |
| 2 | Number of youth participants with increased knowledge about animal management systems. |
| 3 | Number of research programs to understand the processes that control/influence reproduction at the <u>molecular and genetic level.</u> |
| 4 | Number of research programs to add to the understanding of various food animal genomes by <u>improving and integrating genetic maps.</u> |
| 5 | Number of research programs to develop and evaluate new tools and strategies to detect, prevent and <u>control emerging and reemerging livestock and poultry diseases.</u> |
| 6 | Number of research programs to understand the environmental fate and biological effects of vaccines, <u>steroids and other substances fed to animals.</u> |
| 7 | Number of research programs to develop and evaluate management/training strategies for horses to <u>reduce injuries.</u> |
| 8 | Number of research programs to add to the understanding of animal behavior and welfare. |
| 9 | Number of research programs to test new cropping, grazing and feeding strategies for food animals. |

Outcome # 1

1. Outcome Target

Number of adult participants with increased knowledge about animal management systems.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 311 - Animal Diseases

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 2

1. Outcome Target

Number of youth participants with increased knowledge about animal management systems.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development
- 311 - Animal Diseases
- 307 - Animal Management Systems

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 3

1. Outcome Target

Number of research programs to understand the processes that control/influence reproduction at the molecular and genetic level.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes

- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
- 301 - Reproductive Performance of Animals
- 304 - Animal Genome

4. Associated Institute Type(s)

- 1862 Research

Outcome # 4

1. Outcome Target

Number of research programs to add to the understanding of various food animal genomes by improving and integrating genetic maps.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 304 - Animal Genome
- 305 - Animal Physiological Processes

4. Associated Institute Type(s)

- 1862 Research

Outcome # 5

1. Outcome Target

Number of research programs to develop and evaluate new tools and strategies to detect, prevent and control emerging and reemerging livestock and poultry diseases.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 315 - Animal Welfare/Well-Being and Protection
- 308 - Improved Animal Products (Before Harvest)
- 305 - Animal Physiological Processes
- 303 - Genetic Improvement of Animals
- 311 - Animal Diseases

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 6

1. Outcome Target

Number of research programs to understand the environmental fate and biological effects of vaccines, steroids and other substances fed to animals.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 315 - Animal Welfare/Well-Being and Protection
- 307 - Animal Management Systems
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

4. Associated Institute Type(s)

- 1862 Research

Outcome # 7

1. Outcome Target

Number of research programs to develop and evaluate management/training strategies for horses to reduce injuries.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 315 - Animal Welfare/Well-Being and Protection

4. Associated Institute Type(s)

- 1862 Research

Outcome # 8

1. Outcome Target

Number of research programs to add to the understanding of animal behavior and welfare.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 315 - Animal Welfare/Well-Being and Protection

4. Associated Institute Type(s)

- 1862 Research

Outcome # 9

1. Outcome Target

Number of research programs to test new cropping, grazing and feeding strategies for food animals.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 308 - Improved Animal Products (Before Harvest)
- 302 - Nutrient Utilization in Animals
- 307 - Animal Management Systems

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

- Populations changes (immigration, new cultural groupings, etc.)

Description

There are a number of important issues related to livestock production and the public perception of animal production on a global basis, including consumption of animal products and human health, global warming, biotechnology and animal rights, that could affect the outcome of activities in this area.

During the 2013-2014 fiscal year, ABR and MSUE was able to start rebuilding some of its resources after several years of either flat or funding cuts at both the state and federal levels. ABR was able to **fill voids in its research and support teams by hiring quality, skilled people for a variety of positions ranging from farm managers and grant coordinators to faculty and research technicians. Much needed equipment and infrastructure updates were also conducted at many on-campus and outlying research facilities**, helping to keep operations to full capacity. In 2014, ABR and Project GREEN funds helped bridge operating budget gaps at five of the 13 outlying research centers, enabling the repairs of equipment and several buildings. Together, the organizations look to re-invigorate the MSUE presence at the 13 outlying research centers throughout the state.

The **ongoing economic challenges** faced by Michigan continue to affect this planned program area. Consequences have included fewer new hires, delaying the award of new financial obligations, reducing levels of continued funding, and renegotiating or reducing the current scope of assistance through formula funds or block grants. Specifically, a 15 percent decrease in state funding FY2011-2012 coupled with a flat federal funding line for the following two years resulted in the elimination of 72 Extension educator positions across 83 counties, 22 academic and faculty positions on campus and 15 support staff. Administrative positions were reduced from 45 to 19 FTEs. Impacts on ABR came largely in the form of reductions in research infrastructure support. Investments in facility maintenance and equipment were postponed in an effort to avoid eliminating more than 45 research positions (faculty, support staff and graduate assistants) and one research facility had to be closed in light of the reductions. There were also fewer funds to seed research on emerging issues.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Research -- As Hatch dollars are base funding for faculty salaries, there is a built-in evaluation mechanism through annual reviews of overall performance, research productivity and the leveraging of additional research dollars. In addition, many of the research projects have an evaluative element that is required by state and federal-level funding sources that provides documentation related to project assumptions, goals and outcomes. This information is used to determine the overall success of the research initiatives; their contribution to providing practical, real-world solutions and resources to address challenges and problems; and whether continuation funding and/or new dollars are appropriate and necessary as funds are available.

Extension -- As new management strategies are introduced, producers will be surveyed before and after education and training to see how many change their practices.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Food and Non-Food Quality, Nutrition, Engineering and Processing

2. Brief summary about Planned Program

MSU 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 and enhanced food safety and security as well as the development of non-food products (e.g., biofuels, building materials).

For Extension, agricultural and horticultural program activities will focus on enhancing the production and profitability of small-scale agriculture projects and improving community wellness. Renewable resource and sustainable development program activities will use educational processes to facilitate the incorporation of renewable energy into households, governmental offices and businesses, and increase the capacity to develop forest and agricultural-based renewable resources in ecologically and economically sustainable ways.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|---|-----------------|-----------------|----------------|----------------|
| 205 | Plant Management Systems | 0% | | 14% | |
| 402 | Engineering Systems and Equipment | 0% | | 10% | |
| 501 | New and Improved Food Processing Technologies | 0% | | 15% | |
| 502 | New and Improved Food Products | 0% | | 15% | |
| 503 | Quality Maintenance in Storing and Marketing Food Products | 25% | | 14% | |
| 504 | Home and Commercial Food Service | 25% | | 0% | |
| 511 | New and Improved Non-Food Products and Processes | 50% | | 16% | |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins | 0% | | 16% | |
| | Total | 100% | | 100% | |

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Agriculture is one of Michigan's top industries and the only growing sector in the state's economy. The state's agriculture/food system -- including leather, food, floriculture/ornamentals/turfgrass and biomass energy industries -- accounts for \$73.1 billion in total economic activity (direct and indirect) and more than 1 million job. Agriculture generates more than \$42.6 billion in total economic activity. In total, the agricultural/food system employs nearly a quarter of all people working in Michigan. The system is likely second only to the auto industry in importance to the state's economy.

Michigan also has one of the most diverse agricultural industries in the United States. The state is second only to California in variety of crops grown. From field crops such as corn, wheat and soybeans to fruits such as cherries, apples grapes and blueberries; to horticultural crops such as ornamental trees and flowering plants; and livestock, honey and fish, Michigan grows just about anything one can think of except citrus, cotton and tobacco. It's no secret that the past several years have been very difficult for the Michigan economy. The slumping auto industry has deeply affected the state's finances, and downturns in other manufacturing sectors have added to the challenges. Researchers and educators from all disciplines have been pondering how to help boost the state's economy. One solution is to build a strong biobased economic sector on the existing foundation of agriculture, forestry and natural resources, while integrating certain aspects of the industrial and manufacturing sectors. The result will be the advancement of a vital, sustainable biobased sector that, increasingly, will provide a competitive advantage in meeting the growing global demand for renewable sources of materials, chemicals, and energy in products, processes and packaging, as well as new and traditional food products and functional foods.

Priorities are to:

- Connect Michigan industries with the research, education and entrepreneurial activity needed in the basic sciences, engineering, plant science and agriculture to provide the state with a foundation for the vigorous development of a strong biobased sector.
- Develop the processes and technologies to manufacture functional foods.
- Develop new biosensors and DNA chips that can rapidly and accurately detect a broad spectrum of harmful organisms in food and water.
- Identify breeding and genetic improvement related to food quality, nutrition and processing.
- Develop packaging systems to enhance food quality and shelf life.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension
- Multistate Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Preliminary and second generation technology, processes and protocols are available to accomplish many of the priorities, however, they need to become more cost-effective and efficient to ensure industry sustainability, environmental stewardship and human health. Funding will remain constant or increase.

2. Ultimate goal(s) of this Program

To support and build on Michigan's economic sector using the existing foundation for agriculture, forestry and manufacturing, and industrial and manufacturing sectors. This will advance enhanced, sustainable sectors that provide a competitive advantage in meeting the growing global demand for renewable sources of materials, chemicals and energy in products, processes and packaging, as well as new and traditional food products and functional foods that are safe and nutritious.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

| Year | Extension | | Research | |
|------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| 2017 | 5.1 | 0.0 | 6.0 | 0.0 |
| 2018 | 4.9 | 0.0 | 6.0 | 0.0 |
| 2019 | 4.8 | 0.0 | 5.0 | 0.0 |
| 2020 | 4.7 | 0.0 | 6.0 | 0.0 |
| 2021 | 4.7 | 0.0 | 6.0 | 0.0 |

V(F). Planned Program (Activity)

1. Activity for the Program

Activities will be undertaken to:

- Connect Michigan industries with the research, education and entrepreneurial activity needed in the basic sciences, engineering, plant science and agriculture to provide the state with a foundation for the vigorous development of a strong biobased economic sector.
 - Identify and isolate beneficial plant compounds and develop technologies and processes to make new functional foods.
 - Develop new biosensors and DNA chips that can rapidly and accurately detect a broad spectrum of harmful organisms in food and water.
 - Identify breeding and genetic improvements related to food quality, nutrition and processing.
 - Develop packaging systems to enhance food quality and shelf life.

2. Type(s) of methods to be used to reach direct and indirect contacts

| Extension | |
|----------------|------------------|
| Direct Methods | Indirect Methods |
| | |

| | |
|--|---|
| <ul style="list-style-type: none">• Workshop• Group Discussion• Demonstrations | <ul style="list-style-type: none">• Newsletters• eXtension web sites• Web sites other than eXtension• Other 1 (news releases)• Other 2 (annual report/magazine) |
|--|---|

3. Description of targeted audience

Agriculture and natural resources industry representatives, biotechnology company representatives, food industry representatives, state agency representatives, private citizens, entrepreneurs, native American growers.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of research projects focusing on food quality, nutrition, engineering and processing.
- Number of adults trained on new and improved non-food and bioeconomy related products and processes.
- Number of food handlers that increase their knowledge about food safety.

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

| O. No | Outcome Name |
|-------|--|
| 1 | Number of research programs to identify and isolate plant compounds and/or develop processes and technologies to manufacture functional foods. |
| 2 | Number of research programs to develop new biosensors and DNA chips that can rapidly and accurately detect a broad spectrum of harmful organisms in food and water. |
| 3 | Number of research programs to identify breeding and genetic improvement related to food quality, nutrition and processing. |
| 4 | Number of research programs to develop packaging systems to enhance food quality and shelf life. |
| 5 | Number of research programs to connect Michigan industries with research, education and entrepreneurial activity needed in the basic sciences, engineering and plant science and agriculture to provide the state with a foundation for vigorous development of a strong biobased economic sector. |
| 6 | Number of food handlers that increased their knowledge about food safety. |

Outcome # 1

1. Outcome Target

Number of research programs to identify and isolate plant compounds and/or develop processes and technologies to manufacture functional foods.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 503 - Quality Maintenance in Storing and Marketing Food Products
- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

Number of research programs to develop new biosensors and DNA chips that can rapidly and accurately detect a broad spectrum of harmful organisms in food and water.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 503 - Quality Maintenance in Storing and Marketing Food Products
- 402 - Engineering Systems and Equipment

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Number of research programs to identify breeding and genetic improvement related to food quality, nutrition and processing.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 502 - New and Improved Food Products

- 501 - New and Improved Food Processing Technologies

4. Associated Institute Type(s)

- 1862 Research

Outcome # 4

1. Outcome Target

Number of research programs to develop packaging systems to enhance food quality and shelf life.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 402 - Engineering Systems and Equipment
- 503 - Quality Maintenance in Storing and Marketing Food Products

4. Associated Institute Type(s)

- 1862 Research

Outcome # 5

1. Outcome Target

Number of research programs to connect Michigan industries with research, education and entrepreneurial activity needed in the basic sciences, engineering and plant science and agriculture to provide the state with a foundation for vigorous development of a strong biobased economic sector.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 511 - New and Improved Non-Food Products and Processes
- 501 - New and Improved Food Processing Technologies
- 402 - Engineering Systems and Equipment
- 503 - Quality Maintenance in Storing and Marketing Food Products

4. Associated Institute Type(s)

- 1862 Research

Outcome # 6

1. Outcome Target

Number of food handlers that increased their knowledge about food safety.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 504 - Home and Commercial Food Service

4. Associated Institute Type(s)

- 1862 Extension

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Description

These programs are based on ongoing refinement and modification of these priorities and related programs moving forward based on stakeholder input. Public policy changes may affect priorities. Addressing the challenges of obesity and good nutrition, and ensuring career-ready graduates are high priorities for Michigan's elected officials. If priorities change, funds may be reallocated among programs. If funding is reduced, programming will be reduced. A drastic change in population could necessitate a change in priorities to meet the needs of target audiences. Public reactions to, and perceptions of, food safety and quality will influence the research and its outcomes.

The **ongoing economic challenges** faced by Michigan continue to affect this planned program area. Consequences have included fewer new hires, delaying the award of new financial obligations, reducing levels of continued funding, and renegotiating or reducing the current scope of assistance through formula funds or block grants. Specifically, a 15 percent decrease in state funding FY2011-2012 coupled with a flat federal funding line for the following two years resulted in the elimination of 72 Extension educator positions across 83 counties, 22 academic and faculty positions on campus and 15 support staff. Administrative positions were reduced from 45 to 19 FTEs. Impacts on ABR came largely

in the form of reductions in research infrastructure support. Investments in facility maintenance and equipment were postponed in an effort to avoid eliminating more than 45 research positions (faculty, support staff and graduate assistants) and one research facility had to be closed in light of the reductions. There were also fewer funds to seed research on emerging issues.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

As Hatch dollars are base funding for faculty salaries, there is a built-in evaluation mechanism through annual reviews of overall performance, research productivity and the leveraging of additional research dollars. In addition, many of the research projects have an evaluative element that is required by state and federal-level funding sources that provides documentation related to project assumptions, goals and outcomes. This information is used to determine the overall success of the research initiatives; their contribution to providing practical, real-world solutions and resources to address challenges and problems; and whether continuation funding and/or new dollars are appropriate and necessary as funds are available.