2013 Michigan State University Combined Research and Extension Annual Report of Accomplishments and Results

Status: Accepted

Date Accepted: 06/30/2014

I. Report Overview

1. Executive Summary

Michigan State University, the nation's pioneer land-grant university, is charged with generating research-based knowledge and educational programming that is accessible to make informed decisions to enhance lives around the globe. The mission of MSU AgBioResearch - the university's research and development arm for agriculture and natural resources - is to engage in innovative, leading-edge research that combines scientific expertise with an understanding of real-world problems to generate economic prosperity, ensure food safety and security, sustain natural resources and enhance the quality of live in Michigan, the United States and the world. Originally formed in 1888 as the Michigan Agriculture Experiment Station, MSU AgBioResearch strives to maintain a balance between basic and applied research and relies heavily on the input of its constituents and stakeholders in identifying research priorities. An emphasis is placed on integrated and multidisciplinary endeavors with programs continually evaluated for relevance and progress to meet changing needs. The accomplishments and discoveries outlined in this report are reflective of the reasons why MSU AgBioResearch continues today, 125 years after its formation, as one of the most successful entities of its kind.

Michigan State University Extension (MSUE) helps people improve their 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 its programming to meet the current needs of Michigan residents, communities and businesses.

Agriculture is Michigan's second largest industry. The state's agrifood system is estimated at $96 billion in economic activity (direct, indirect and induced) and accounts for more than an estimated 900,000 jobs. Food and agriculture represent roughly 22 percent of the workforce in Michigan. The agrifood system is likely right behind the manufacturing industry in importance to the state's economy. With more than 200 commodities, Michigan also has one of the most diverse agricultural industries in the nation. Home to more than 56,000 farms across 10 million acres of farmland, the state is second only to California in the variety of crops produced from corn, wheat and soybeans to ornamental trees, livestock and fish.

In 2013, leaders from the College of Agriculture and Natural Resources participated in 13 open forum meetings across Michigan to listen to stakeholder opinions and concerns on issues relative to education, outreach and research. The "What's Now? What's Next?" tour was deemed highly successful as an effective way to engage in meaningful dialogue with residents and farmers statewide.

At the same time, Michigan farmers and food processors 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, based on a survey conducted in December 2013, gauges the current business climate of the state's food and agriculture 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, down only one point from the April 2013 survey. In contrast, they rate Michigan's overall economic outlook at a healthy 120, up five points from April.

The MSU Product Center is emblematic of the way MSU AgBioResearch and MSU Extension work one-on-one with entrepreneurs to supply objective, evidence based methods for starting and growing businesses. In fiscal year 2013, counselors advised 482 clients -- that's two entrepreneurs every business

day -- which resulted in 73 new business ventures, more than $3 million in total capital formation and 258 new or retained jobs. The Product Center is also working diligently to establish the Food Processing Innovations Lab which will help midsized companies develop new and improved products by allowing them to establish a commercial production line to test new procedures. It will also help prepare students for the workforce by giving them unmatched hands-on experiences in food science.

The success and accomplishments of MSU AgBioResearch and MSUE are fueled by close ties 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 any geographical borders. Further, reasonable investing for Michigan's success in the past year has resulted in:

Leverage: Every dollar that the federal government invests in MSU AgBioResearch and MSUE leverages about $10.15 in external contracts, grants and revenues that serve the state's residents. Every federal dollar is leveraged by $2.91 of state appropriations. Michigan investments in MSU AgBioresearch and MSUE leverage an additional $817 million in external contracts, grants and other revenues that serve Michigan residents.

Community Benefits: Federal investment extends the reach of MSU AgBioResearch and MSUE that generate as much as $367 million in benefits to Michigan and the nation. For every federal dollar invested, MSU AgBioResearch and MSUE generate as much as $19.80 in benefits to the state and nation through educational programs and research.

Benefit/Cost Ratio: When state funds, community benefits and economic stimulus are combined, the estimated benefits to Michigan residents and the nation exceed the initial federal investment 55:1. It is important to note that this report reflects only a portion of AgBioResearch and MSUE and not the whole breadth of research and educational initiatives. AgBioResearch's total budget for FY 2013 was $91.62 million, with this report representing $14.5 million in federal match dollars and equivalent match. MSUE's total budget was $70.80 million with this report representing $8.53 million federal 3 b&c with $8.53 million match.

Further support of of MSU AgBioResearch and MSUE working together can be seen in their joint 2012-13 Legislative Report at:
http://agbioresearch.msu.edu/uploads/files/About_Tab/Leg_Reports/LegislativeSummaryReport-2013-WEB_9-23-13.pdf

MSU AgBioResearch 2013 Quick Facts:
124 Hatch-funded researchers representing 68 FTEs
282 active projects
73 patent applications submitted
20 patents received
296 peer-reviewed publications

Key Research Accomplishments for FY 2013 include:
Research on Toxic Chemicals -- There are more than 1,200 hazardous waste sites in the United States. Sixty-seven of them are located in Michigan. They have commonly become known as Superfund sites after the program of the same name established by the US Environmental Protect Agency to clean up contamination at these locations. Research performed by a multidisciplinary team of toxicologists, microbiologists, statisticians and engineers are working on understanding the heath risk from chemicals found at these sites as well as remediation technologies to eliminate the potential for exposure at these

Developing Enriched Models to Monitor Michigan Black Bear Populations -- In 2008, the Michigan Department of Natural Resources (MDNR) estimated that 18,000 bears lived in MI. Since then the agency has grappled with indices, estimators and costly survey measurs that provide conflicting projections of how the population has changed over time. MSU AgBioResearch scientists are developing a reliable, cost-efficient method to monitor bear population dynamics and help the MDNR assess hunting license quotas, a key component of black bear management.

Deciphered Sea Lamprey Genome Holds Key for New Management Tactics -- The Sea Lamprey is one of the oldest and most ecologically dangerous invasive species in the Great Lakes. Landmark findings by MSU AgBioResearch scientist have yeilded hope for both new sea lamprey management techniques and insights into vertebrate evolution.

Managing Nitrous Oxide Through Carbon Markers -- Nitrous oxide is one of the top three greenhouse gasses, according to the US Environmental Protection Agency. MSU AgBioResearch scientists have developed an incentive for farmers to limit nitrous oxide output. Farmers are credited for more precise fertilizer use, which results in lower nitrous oxide emissions.

Studying Nannochloropsis as a Biofuel Source -- Algae have become an attractive fuel source because they produce little in the way of gre3enhouse gasses, require less land then other biofuel crops and do not compete with food production. N. oceanica is being studied as an example of algae's biofuel potential and to compare it to the capabilities of yeast. Unlocking the genome offers advancements for not only algal biofuels, but also for agricultural biofuels and medicine.

Turning Agricultural Residues into Feed and Fuel -- Worldwide, farms and other agricultural operations annually produce billions of tons of inedible plant matter--crop byproducts with high levels of difficult to digest cellulose. MSU AgBioResearch scientists are developing a process to turn cellulosic biomass into an economical source of biofuel and animal feedstock. If successful, farmers would gain an additional source of low-cost livestock feed as well as a new source of revenue by selling their previously discarded crop residues.

Genetic Technologies for Combating the Soybean Aphid -- A 2008 sruvery from the US Department of Agriculture National Agricultural Statistics Service found that 89% of the 63.6 million acres of soybean fields in the US had been exposed to the soybean aphid, a devastating insect pest. Soybean aphids can reduce the crop yield up to 50% and spread viral diseases. Using traditional plant breeding practices and cutting edge gene identification technology, AgBioResearch scientists have been able to detect a set of genese native to the soybean plant that make its it resistant to the predations of soybean aphids.

Improving Validation Methods to Ensure Safety of Low-Moisture Foods -- In 2009 a Salmonella outbreak in peanut products spanned 46 states, caused 714 people to become ill, contributed to 9 deaths and resulted in one of the largest food recalls in US history. AgBioResearch scientists are collaborating to ensure the effectiveness of pasteurization processes used on low-moisture foods. They are working to generate tools and models that can be generalized and applied to a range of products, ensuring the safety of that product.

Discovery of New Genetic Pathway Aids in Success of Apple Industry -- MI Apple producers were expected to harvest a record-setting 30 million bushels in 2013. One of the most important characteristics of the food we eat is flavor, which is composed of taste and aroma. AgBioResearch scientists have discovered a genetic pathway that plays an important role in producing apple aroma profiles, a key quality that helps MI apples remain competitive in national and international markets.

MSU Extension 2013 Quick Facts:

Outputs

2013 Total Adults Participants: 166,977

Institute for Agriculture and Agribusiness

Business Management
61,277
Animal and Plant Production/Environmental Quality
5,596
Bioproducts and Bioenergy
536
Total for Agriculture and Agribusiness
67,409

Institute for Children and Youth*

Academic Success
123,59
Capacity Building
2,631
Career Education/Work Force Preparation
381
Leadership & Civic Engagement
1732
Total for Children and Youth
17,103

Institute for Greening Michigan

Sustaining Community Prosperity
6,490
Natural Resources Stewardship
3,023
Government and Public Policy
4,315
Community Food Systems
3,566

Seagrant
5,577
Total for Greening
22,971

Institute for Health and Nutrition

HN-2: Food Safety
5,856
HN-3. Nutrition and Physical Activity
48,433
HN-4: Social and Emotional Health
3,470
Total for Health and Nutrition
59,494

Children and Youth

Unduplicated 4-H Youth Participants
200,773
Children 0-5 years old
3,235

Science, Engineering, and Technology

Consumer and Family Science
4,766
Biological Sciences
25,276
Technology and Engineering
6,922
Physical Sciences
2,029
Environmental Education / Earth Sciences
49,709
Ag in the Classroom
9,303
Animals
60,545
Plant Science
12,558
Total Science, Engineering, & Technology
171,108

Citizenship

Civic Engagement
3,877
Community / Volunteer Service
11,304
Leadership and Personal Development
42,629
Communications and Expressive Arts
36,978
Total Citizenship
94,788

Healthy Lifestyles

Foods and Nutrition
59,850
Health
5,474
Personal Safety
1,482
Total Healthy Lifestyles
66,806

Note that approximately 25% of these outputs were used in this report to show results of effort from formula and match dolllars.

Key Extension Accomplishments for FY 2013 include:

Enhance Michigan's First Green Industry: Agriculture and Agribusiness Institute

Indicator
Reported
# of acres adopting practices to increase yield, improve quality, or decrease inputs
644,783
# of farms adopting practices to increase yield, improve quality, or decrease inputs
896
$ changed due to yield/productivity change
$3,082,888
$ changed due to change in input costs
$1,059,855
# of farms adopting practices that manage risks
1,119
# of acres adopting practices that manage risks
157,731
# of acres adopting technology or tools to manage risks
10,778

$ value of product protected
$34,418,951
$ value of product gained
$1,820,166
$ value of product saved
$31,046,366
$ value of products protected
$1,902,796
$ value reduced variability (due to yield, quality, income)
$1,273,470
Change in nutrient use, lbs*
103,684
Change in pesticide use, lbs*
2254
Change in sediment retained, tons
2000
Number that change away from broad spectrum products
80
New acres under irrigation management
1,962
Amount of fossil energy displaced by bioenergy, BTU's
2,890,011
Revenue Protected (Annual Gross Sales) of the businesses that developed and implemented successful business transition plans
$331,256,000
# of business expansions
62
$ tax planning savings, annually
$1,000,132

Preparing Michigan's Children and Youth for the Future Institute

Indicator
Reported
# of adults that increase knowledge and skills in early childhood content areas
346
# of caregivers , community partners, and families that are aware of MSUE early childhood resources and opportunities
331
Number of participating youth indicating the ability to apply science knowledge
593
# of youth who attend post-secondary education
1,568
# of community partners, educators, and families that are aware of MSUE 4-H science resources and opportunities for youth.
424
Number of youth participating in programs who report an increase in science knowledge.
761
Number of participating youth indicating the ability to apply problem solving, critical thinking, and decision-making life skills.
1,973

# of youth indicating the ability to apply the use of life skills gained through participation in 4-H.
2,316
# of Michigan youth who apply life skills learned in their daily lives.
1,964
Number of participants indicating an increase in knowledge, skills, or confidence by using facilitative processes, conflict management skills, or civic participation practices
331
Number of participants who report that they are better prepared to make a change in their community or organization as a result of the training provided by MSUE
231
Number of youth that gain knowledge and skills necessary for leadership.
563
Number of adults that gain knowledge and skills necessary for leadership.
212
Number of youth participants that set a goal for their career or job.
1,590
Number of youth participants that gain self-awareness as it relates to future career possibilities.
1,537
Number of youth who indicate an increase in knowledge of financial concepts.
146
Number of youth participants that learn about the basic skills necessary for employment.
128
Number of youth that apply global and cultural competencies.
3,672
Number of youth that are culturally and globally competent leaders and citizens.
3,672
Number of youth that gain knowledge and skills in global and cultural competencies.
3,707

Improving Health and Nutrition Institute

Indicator
Reported
Number of adults completing the series demonstrate adoption of healthy eating practices by reporting an increase in fruits consumption during a typical day
2,755
Number of adults completing the series demonstrate adoption of healthy eating practices by reporting an increase in vegetable consumption during a typical day
3,160
Number of adults completing the series demonstrate adoption of healthy eating practices by reporting a positive change in whole grains consumption during a typical day (e.g., change from never to seldom, seldom to sometimes, sometime to most times, and most times to always)-V1
2,123
Number of adults completing the series demonstrate gains in awareness of healthy eating practices by reporting a positive change in how often they think about healthy food choices when deciding what to feed their family.
1,865
Number of adults completing the series demonstrate adoption of healthy habits by reporting a positive change in the time spent being physically active on a weekly basis.
1,815

Number of adults completing the series demonstrate adoption of healthy eating practices by reporting a positive change in exit intake nearer recommended amount with regards to age, sex, and level of physical activity
5,707
Number of adults completing the series demonstrate improvement in one or more food resource management practices (i.e., plans meals, compares prices, does not run out of food, or uses grocery lists).
3,341
Number of the adults completing the series demonstrate improvement of the food safety practices of thawing and storing foods.
2,496
Number of youth demonstrate adoption of healthy eating by improving intake of fruit servings in a usual day.
3,504
Number of youth completing the series will demonstrate an increase in the knowledge necessary to identify food groups.
1,181
Number of youth demonstrate adoption of healthy eating by decreasing intake of sugary drinks.
829
Number of youth demonstrate adoption of healthy eating by improving intake of vegetable servings.
2,573
Number of youth demonstrate adoption of healthy eating by improving intake of whole grains servings.
871
Number of youth completing the series demonstrate adoption of increased time spent in physical activity by reporting a positive change in the time spent being physically active on a weekly basis.
3,084
Number of youth report increasing frequency of food safety practices.
2,790
Number of adults demonstrate adoption of increased time spent partially and exclusively breastfeeding.
1,008
Number of Adults demonstrate adoption of increased initiation of breastfeeding.
568

Greening Michigan: Leveraging Natural & Human Assets for Prosperity Institute

Indicator
Reported
Number of participants that keep track of spending and income by creating a personal budget.
236
Number of participants that save money regularly by spending less than is earned
259
Number of participants that pay down debt and adopt behavior change that improves their credit score.
238
Number of participants that conduct a home energy audit.
180
Number of participants that can identify SMART financial goals.
234
Number of adult and youth participants who implement a practice to mitigate an ecosystem threat.
1,550
Number of adult and youth participants who indicate their awareness of human impacts, such as exotic invasive species, habitat damage or non-point source pollution.

53
Fostering: Number of community leaders with increased awareness and skills in measures to prevent damage from wild fire and local regulation to deal with wildfire issues.
62
Number of youth program participants who increase knowledge on tribal, state, and local government.
12
Governance: Number of boards who have adopted new or improved rules or processes for compliance
13
Governance: Number of participants that report their board used new skills or techniques to improve the effectiveness of their meetings and/or processes at the local or regional level.
184
Number of participants who show understanding of relevant laws and the practical impacts of those laws on their boards
233
Number of participants who increase knowledge of their board's structure, functions and duties, and/or operational best practices
394
Number of people with increased knowledge of community food systems. (measured by a quiz and a specific score means knowledge gain. (Short term.)
1,357
Number of people that have an increase in awareness of the goals of the Michigan Good Food Charter.
983
Number of Sea Grant facilitated curricula adopted by formal and informal educators.
140
Number of people engaged in Sea Grant supported informal education programs.
3,430
Number of acres of coastal habitat protected, enhanced or restored as a result of Sea Grant's activities.
1,051

Total Actual Amount of professional FTEs/SYs for this State

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	178.0	0.0	65.0	0.0
Actual	218.7	0.0	68.0	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

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

2. Brief Explanation

With Michigan's agricultural and natural resource industries in constant transition, MSU AgBioResearch priorities and MSU Extension educational goals must remain fluid and flexible. Research goals are continually evaluated for relevance and impact at local, state and regional levels. Strategic priority areas address the research needs of the Michigan agriculture and natural resources industries, but are also linked to national and global goals and initiatives. Through strategic planning with MSU AgBioResearch-affiliated colleges, MSU Extension staff and key stakeholder groups, priority areas are reviewed annually. This process involves industry experts, university faculty, MSU Extension and AgBioResearch advisory council members and research center advisory committee members, as well as scientific review by peers (local, national and international). MSU Extension uses several continuous processes that assist in setting priorities and evaluating program goals and plans. At the local level, the interested public, government officials, advisory group members and industry experts are involved in broader stakeholder processes as well as the review of individual educator plans. These goals and plans are also reviewed by state leaders and industry experts for quality and relevance and by the MSU AgBioResearch and MSU Extension directors, who not only evaluate them, but use them in regional and statewide presentations to explain future plans.

Jointly, MSU AgBioResearch and MSU Extension address issues of concern in communities with research and teaching by using a network of citizen advisory groups at the local and state levels. Thirteen district Extension councils identify and prioritize issues, seek collaborations and resources and communicate to others the importance of MSU Extension educational programming. Citizen Advisory Councils help establish research priorities at the 13 outlying MSU AgBioResearch Centers and on-campus facilities. The MSU Extension and MSU AgBioResearch Council serves as liaison among district councils, research center advisory groups and state agencies and organizations.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged 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)

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 Extension just completed a major restructuring effort in 2011-2012. The effort was underpinned by commitments to reducing administrative overhead, maintaining organizational agility, and responsiveness, accountability to stakeholders, and continued emphasis on focused, effective educational programming across the state. Throughout this process, MSU Extension staff

participation was encouraged by publishing weekly newsletters form 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 five town hall meetings and five meetings with local stakeholders at various locations across the state to discuss the restructuring plan and solicit staff input to guide the plan and identify and develop four new institutes within the MSU Extension framework:

- Preparing Michigan's Children and 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

Thirteen District Advisory groups were established to help in collecting local stakeholder input and assist in the development of priorities.

Further, numerous individual meetings were held with staff, stakeholder advisory groups and the MSU AgBioResearch/MSU Extension 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 Townships Association and state legislators.

Following the establishment of the four institutes, a statewide needs assessment - Advance Michigan -- was undertaken 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. Survey results were used to guide logic models for specific priorities in each institute and a statewide plan of work that will continue into 2015. In addition, MSUE and MSU AgBioResearch continued to strengthen its collaboration with the North Central Region to identify common issues among stakeholder input, pool resources and improve multi-state efforts.

On the research side, MSU AgBioResearch and MSU Extension continue to help develop the framework for a new, inclusive, industry supported partnership. This Michigan Agriculture and Food Strategic Growth Partnership -- which came about as a result of the 2011 Governor's Summit on Production Agriculture and the Summit for Food Processors, and included input from the agriculture industry and state government -- has developed a plan based on the Governor's five-year challenge to create a stronger and even more vibrant agriculture. The Strategic Growth Initiative grant program, a joint venture between the Michigan Department of Agriculture and Rural Development and the Michigan Economic Development Corporation, is part of that initiative. Through the program, MSU researchers received $1.6 million of the $2.25 million in grants announced in late 2013. Some of the future projects include efforts to reduce insecticide and fungicide levels on blueberries; reduce manure handling costs for swine producers and mitigate environmental impacts on the state's water resources; assess the potential for production of specialty food ingredients derived from Michigan grown and processed dry beans; and the development of a system to utilize meat processing wastes for energy production.

The MSU Product Center continues to be emblematic of the way MSU Extension and AgBioResearch work one-on-one with entrepreneurs to supply objective, evidence-based methods for starting and growing businesses. In FY 2013, counselors advised 482 clients resulting in 73 new business ventures and more than $3 million in capital formation. The center is also working to establish the new Food Processing Innovations Lab, which will help mid-size companies develop new and improved products by utilizing a commercial production line.

In an effort to improve stakeholder relations, leaders from both MSU AgBioResearch and Extension also participated in a first-time series of 13 open forum public meetings held throughout Michigan in 2013. Called the "What's Now? What's Next?" tour, the meetings gave stakeholders

across the state an opportunity to ask questions of and listen to the leaders from each of the organizations. Facilitators of the event deemed it 'highly successful' at improving communications between the organizations, key stakeholders and the interested public.

The partnership is meeting that challenge with a commitment to a comprehensive review in year four to evaluate the accomplishments during its first three years.

2(A). A brief statement of the process that was 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 and partners -- representatives in the agricultural, food, natural resources and bioeconomy industries and their constituent companies, organizations, farms and businesses; and with other public sector partners from federal, state and local governmental organizations and other universities. In reality, every Michigan citizen is both an AgBioResearch and an MSU Extension stakeholder!

Using the methods checked above, the emphasis is on keeping up-to-date on key internal and external stakeholders (e.g., agricultural producers, commodity groups, food processors and the tourism, fisheries and forestry industries), 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 statewide online issues identification process that was completed in the Fall of 2011, the previous Strengthening Michigan's Economy comprehensive survey before it, and other ongoing outreach efforts offer multiple ways for people in various roles and locations to help identify the issues and opportunities for MSU AgBioResearch priorities and MSU Extension educational programming in the years ahead.

Community-based discussions in all Michigan counties, involving local advisory committees, the MSU Extension/AgBioResearch councils and others are held to discern what issues and opportunities stakeholders believe should be addressed related to research and programming. Citizen focus groups are also used to identify issues and opportunities in Michigan and assign a priority ranking to each. Community groups, commodity and producer groups and other state and local partners are periodically asked what issues and opportunities should be explored and addressed.

Faculty member focus groups, with representatives from Michigan colleges and units, are held as needed to glean faculty member perceptions on emerging Michigan issues and opportunities and to identify ways that MSU science projects and/or initiatives might address them. MSU faculty members and MSU AgBioResearch/MSU Extension 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 AgBioResearch Center managers, synthesize and prioritize contentspecific program and research needs identified by the various councils and advisory committees. Working groups within each institute synthesize and prioritize content-specific program and research needs generated from the input of their advisory bodies and develop programs to meet these needs as well as methods for evaluating their impacts. Needs are fine-tuned as additional input is received.

2(B). A brief statement of the process that was 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.

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 GREEEN, the Animal Agriculture Initiative and commodity advisory teams. There are extensive conversations and visits that also take place throughout the year with local, state and federal officials, and commodity group and industry representatives from the agricultural, natural resources and renewable energy industries.

For MSU Extension, town hall meetings, individual meetings, feedback via email, blogs and surveys and new formed District Advisory groups are all being used to inform the newly restructured MSU Extension, including the priorities that should be set under each of the four new institutes. More specifically, the past two years was spent collecting input from county commissioners. A series of meetings was held with commissioners across the state. A task force was then set up to help determine how the partnership could work. The task force met and then sent a mailing (that also included a url to a website with additional information) to all county commissioners, inviting them to participate in several webinars to discuss the Memorandum of Agreement that was being put together to formalize the partnership. A survey was also sent out to all commissioners, laying out three scenarios on how to approach the partnership. Survey participants were asked which of the options they preferred and how they thought it could be implemented to ensure that the right costs are allocated to the counties and to MSU Extension. Based on this feedback, changes were made. The MOU (Memorandum of Understanding) was executed in FY 2012 in 80 counties.

For MSU AgBioResearch, multiple meetings were held with commodity groups, legislators and key stakeholders representing the key agrcultural 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 MSU AgBioResearch Centers and to provide recommendations on how to best move forward in implementing needed changes.

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.

Due to stakeholder input, AgBioResearch has focused more sharply on renewable energy and biobased products that can help boost the Michigan economy, including fuels, chemicals, neutraceuticals and food products; 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 Initi t ative. From an operational perspective, MSU AgBioResearch has used stakeholder input to guide its decision making process around the consolidation and restructuring of its 13 AgBioResearch centers and various on-campus units.

MSU Extension utilized the stakeholder input in forming the four institutes and the 16 work groups that guide them. The input has been useful in setting priorities and focusing on more with fewer resources.

Brief Explanation of what you learned from your Stakeholders

Things AgBioResearch learned from its stakeholders:

· Genetic research needs to be a critical area of focus.
· Food safety and security and a safe and secure water supply are critical priority areas for research activities.
· Research activities and MSU must stay current and include newer technologies. The organization s need s to continue to build and maintain strong partnerships both internally and externally.
· Efforts of MSU Extension and AgBioResearch are critical to the success of the $91.4 billion food and agriculture industry in Michigan .
· Solutions and innovations that come from MSU AgBioResearch will be even more critical in the future for residents in Michigan, the nation and the world.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
8207767	0	5929537	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	9281514	0	5709818	0
Actual Matching	9281514	0	5929537	0
Actual All Other	0	0	26957461	0
Total Actual Expended	18563028	0	38596816	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	4821473	0	0	0

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
7	Global Food Security and Hunger
8	Climate Change
9	Sustainable Energy
10	Childhood Obesity
11	Food Safety

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

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

☑ Reporting on this Program

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	10%		8%	
702	Requirements and Function of Nutrients and Other Food Components	0%		4%	
703	Nutrition Education and Behavior	15%		3%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%		8%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	5%		5%	
721	Insects and Other Pests Affecting Humans	0%		2%	
723	Hazards to Human Health and Safety	0%		12%	
724	Healthy Lifestyle	15%		12%	
801	Individual and Family Resource Management	15%		0%	
802	Human Development and Family Well-Being	10%		10%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%		10%	
805	Community Institutions, Health, and Social Services	0%		18%	
806	Youth Development	30%		8%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	53.0	0.0	10.5	0.0

Actual Paid Professional	121.0	0.0	10.0	0.0
Actual Volunteer	94.5	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
4899209	0	856470	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
4899209	0	889431	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	4043619	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research programs to:

- Assess the imapact of school tobacco policy on preventing and reducing Michigan youth smoking.
- Develop a better understanding of public benefits for policy development in recreation and tourism reource 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. Brief description of the target 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.

3. How was eXtension used?

eXtension was a major part of our multi-state effort (along with work with the North Central Region). In this area, 47 educators responded to Ask an Expert on 340 issues.

Members were activiely involved the following Communities of Practice (CoP) for this area:

Community Nutrition Education
Creating Healthy Communities
Diabetes
Diversity, Equity and Inclusion
Drinking Water and Human Health
eXtension Alliance for Better Child Care
Familes and Child Well-Being Learning Network
Families, Food and Fitness
Family Caregiving
Financial Security for All
For Youth, For Life
Healthy Food Choices in Schools
Home Energy
Just In Time Parenting
Military Families
Public Deliberation
Teen Leadership
Volunteerism

A example is:

Canning Green Beans

I recently canned pints of green beans using the water-bath method. After several days, I noticed the water in the beans cloudy and slimy. I was informed by a MSU extension staffer that I should immediately through the beans away as they were not safe to eat at all because they cannot be processed with a water-bath and I should have used a pressure cooker. My question is after throwing the beans out, can I reuse the canning jars since I rewashed them in the dishwasher? I want to can more beans but want to

know if the jars are safe to use now that they have been exposed to botulism since I canned them wrong or should I throw those jars out also? Thank you for a prompt reply.

Reply

Happily, I can tell you that it is A-OK to re-use your jars. You did the correct thing by running them through a dishwasher. You can also reuse the rings that you used, but you need to use new lids (the round disc-type piece that fits directly on top of the jar).

You received the correct information that a pressure canner must be used because beans are a low-acid product. Here is a link to a University of Wisconsin Extension canning bulletin that people find especially helpful: http://learningstore.uwex.edu/Canning-Vegetables-Safely-P942.aspx
When you click <view PDF> at the bottom the bulletin will come up on your screen and can be downloaded or read at no charge.'

The Michigan State University Extension fact sheet produced especially for snap beans may be found at: http://web2.msue.msu.edu/bulletins2/product/using-storing-and-preserving-snap-beans-1304.cfm Again, this can be read from your computer screen, downloaded or printed for personal use at no charge.

As a side note, you could also make "Dilly Beans", a pickled product, from your beans. Since acid is added in the form of vinegar these can be processed using a hot water bath instead of a pressure canner. Learn more at: http://learningstore.uwex.edu/Homemade-Pickles-and-Relishes-P943.aspx

Best wishes in your canning endeavors. If you have any questions please e-mail me or call my local office (information below) - I'll be glad to help!

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	18264	54792	20997	62991

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2013
Actual:	1

Patents listed

MICL01680: Value added products for improving human, animal and plant health - 8,337,914 (12/25/12)

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	2	44	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research programs on human health, environment, family, youth, society and community.

Year	Actual
2013	43

Output #2

Output Measure

- Number of adult participants trained in healthy lifestyles.

Year	Actual
2013	12541

Output #3

Output Measure

- Number of youth participants trained in healthy lifestyles.

Year	Actual
2013	16701

Output #4

Output Measure

- Number of adult participants trained in human development and family well-being.

Year	Actual
2013	867

Output #5

Output Measure

- Number of youth participants trained in human development and family well-being.

Year	Actual
2013	2464

Output #6

Output Measure

- Number of adult participants trained in youth development.

Year	Actual
2013	3089

Output #7

Output Measure

- Number of youth participants trained in youth development.

Year	Actual
2013	1832

Output #8

Output Measure

- Number of adult participants trained in family resource management.

Year	Actual
2013	1767

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of research programs to determine the relationship between family meals/lifestyle factors, education/food choices, general healthand 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 human development and family well-being.
8	Number of adult participants with increased knowledge of youth development.
9	Number of youth participants with increased knowledge of youth development.
10	Number of research programs to develop more effective environmental/natural resources management systems.
11	Number of adult participants with increased knowledge of family resource management.
12	Number of research programs that study the function of nutrients and other components related to human health.

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	15

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Overweight people are at serious risk for cardiovascular disease, diabetes and some forms of cancer, and the risk is lifelong. The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity reports that overweight adolescents have a 70 percent chance of becoming overweight or obese adults, and this risk increases to 80 percent if a parent is overweight or obese. Further, obesity associated coronary heart disease is now the No. 1 cause of mortality in the United States. Parents can significantly improve the health of their children by initiating family lifestyle changes in activity and eating behavior.

What has been done
Research to: generate information to make it easier for citizens to eat healthier and be more physically active; determine the effects of food marketing on children's dietary behavior; determine the role of inflammation in the development of diabetic retinopathy; determine the role of diet, obesity and inflammation on colon cancer risk; determine the effect of calorie restriction on the body's innate immune response to influenza; and develop effective prevention and intervention methods for E. coli-related illnesses.

Results
Collected data to assist food scientists and processors design healthier foods for developed and under-developed countries by investigating the use of low-glycemic index dry beans instead of high-glycemic starchy foods. This would aid in reducing the incidence of Type 2 diabetes.

Developed and implemented standardized, competency-based food safety education and training programs. That was translated and adapted to Vietnamese and Thai. A 16-module training programs on food safety for global food manufacturing was developed and pilot tested in China.

More than 160 food safety professionals completed training workshops.

Studies on school interventions on nutrition behaviors among low-income middle schools students are informing state and national-level nutrition policy and programs related to school environment and policy change to improve student dietary intake. School health teams were established at 4 Grand Rapids schools with training focused on basic nutrition and physical activity.

Published study results of findings regarding advergames designed to promote food to children and generally promoting food that are high in fat, sodium and sugar. Children's exposure to these games result in more positive attitudes towards the game and the brand than passive advertizing messages.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Michigan residents are exceptionally vulnerable due to chronic exposure to complex mixtures of endocrine disruptors that include legacy environmental contaminants within the Great Lakes basin(e.g., dioxin, PCBs, DDT), numerous pesticides and herbicides from the diverse and intense agricultural activities within the state, and the broad range of industrial activities that contribute to the overall pollution burden.

What has been done
Research to: comprehensively assess the toxicity of endocrine disruptors to determine the health risks of this contaminant to human health and wildlife in Michigan; study chronic respiratory diseases caused by air pollutants to better understand how nasal tissues and cells may respond to inhaled intoxicants;determine why some species of birds are more likely to support infectious agents than others; and to evaluate pesticide use and mitigate pesticide misuse to reduce environmental and human risk.

Results
Published papers on prevalence of Newcastle disease virus and avian influenza in double-crested cormorants and investigated the health of migrating landbirds in relation to habitat use.

Test analysis for the turfgrass pesticide certification exam and the certified crop advisors exam resulted in poor questions being identified and rewritten or substituted to improve the quality, fairness and reliability of the exams.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety
805	Community Institutions, Health, and Social Services

Outcome #3

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Healthy, vital communities with active citizenry are better equipped to address the challenges facing many of today's families. Whether the issue is economic development, youth aging, family

dynamics, demographics or rural and urban security, better models for the human health and human services sector are critical to human development and overall well-being.

What has been done
Research to: transition young people who age out of foster care; develop healthcare packaging that is easier to access, particularly for aging consumers and people with disabilities; develop models for preventive and early intervention strategies for children living with a family member with a serious illness;examine the relationship between the number of foster home placements for youth and the number of community connections as emancipated adults;examine the relationships between emotion-related socialization behaviors and infants', toddlers' and preschoolers self-regulation and social-emotional competencies; and to develop models and family-based interventions that advance the well-being of National Guard soldiers and their families post-deployment to a combat zone.

Results
We have empirically-tested an emotion-related parenting construct and validated its association with toddler self-regulation in a low income population. Results will better inform understanding of associations between dimensions of self regulation as well as shed light on how various emotion-related parenting behaviors (emotional supportiveness, emotion talk and emotion coaching) are related to domains of self regulation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #4

1. Outcome Measures

Number of adult participants with increased knowledge about healthy lifestyles.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	11287

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There is a high level of people living at or below the poverty level; high levels of obesity among adults; and low levels of adults consuming the adequate amount of fruits and vegetables in Michigan. These are factors that affect the quality of life of adults and their families, and increase their likelihood of chronic diseases.

In Michigan, 17.5% were considered below the poverty level in 2011 (US Census Bureau, 2011).

Based on USDA data, 1,784,755 people (18.1%) are receiving Supplemental Nutrition Assistance Program benefits- Bridge Card in Michigan (USDA Food and Nutrition Service, 2013).

Through 2009-2011, 3,855,000 people (14.2%) in Michigan were considered food insecure, and 5.6% of people in Michigan were considered to have very low food security (USDA ERS, 2011).

About 48% of all SNAP participants are in working families (USDA Food and Nutrition Service, 2011), and 22% of those who receive SNAP Benefits in Michigan are adults living with children (USDA Food and Nutrition Service, 2011).

Michigan has the 10th highest prevalence of obesity in the United States (Michigan Department of Community Health, 2011). Three out of every ten (30.3%) adults in Michigan are obese, while approximately 35% of adults are overweight (Michigan Behavioral Risk Factor Survey & Weight Status Among Michigan Adults, 2009). 11.9% of Michigan youth are considered obese (CDC YRBSS, 2009).

In 2009, 77.4% of Michigan adults did not consume adequate amounts of fruits and vegetables (CDC BRFSS, 2009). 20% (1/5) of Michigan youth eat the recommended daily allowance of five servings of fruit and vegetables a day (Michigan Youth Risk Behavior Survey , 2009).

In 2009, the prevalence of inadequate physical activity among Michigan adults was 48% (MiBRFSS, 2009).

23.6% of Michigan?s adults reported that during the past month, they had not participated in any physical activity (CDC, BRFSS, 2009-2010).

In Michigan, only 49.4% of adolescents were physically active for at least 60 minutes/day on 5 or more days (CDC, YRBS, 2011).

According to Michigan Food Safety, the three main causes of foodborne illness are (2009): improper temperatures, poor personal hygiene and cross-contamination of food.

Preventing or managing chronic diseases is the top health challenge of the 21st century. Seven out of 10 deaths each year are from chronic diseases. More than 75% of healthcare spending (in Michigan and the U.S.) is for people with chronic diseases including heart disease, stroke, cancer, diabetes, kidney disease, and dementia. Leading a healthy lifestyle can greatly reduce the risk of developing chronic diseases (Michigan 4 by 4 Wellness Plan).

What has been done

MSU Extension provides nutrition education in all 83 counties of Michigan through a variety of programs and funding sources (numbers here reflect approximately 25% of participants in this area). Nutrition and physical activity education are means to prevent obesity among adults and to prevent and decrease chronic diseases. Michigan State University (MSU) Extension delivers high-quality and affordable education to serve the needs of children, youth, families and communities in urban, rural and suburban areas.

MSU Extension programming promotes healthy life-styles and educates Michigan residents, allowing each individual to acquire the skills to take control of his or her personal health. The

Nutrition & Physical Activity Workgroup (NPA)of the Health and Nutrition Institute of MSUExtension works to improve the knowledge, skills, attitudes and behavior of individuals regarding nutrition and physical activity. Through promotion, planning and delivery, MSU Extension staff members provide education to diverse audiences at the local, county and state level. Programs aim to help children, youth, adults and seniors incorporate healthy and affordable nutrition choices into their lifestyles while increasing physical activity for an overall increased community well-being.

Through our educational programs, adults learn about MyPyramid and MyPlate; making the most of their food dollars; menu planning; understanding a recipe; keeping food safe; nutrition and health; improving physical activity and feeding a family.

Results
An evaluation found:

Dietary Quality

After the series, participants reported the following changes in the area of dietary quality:

Adults:

98% of adults completing the series demonstrate adoption of healthy eating practices by reporting a positive change in exit intake nearer the recommended amount with regards to age, sex, and level of physical activity (Caloric Balance).

40% of the adults completing the series demonstrate adoption of healthy eating practices by reporting an increase in fruit consumption during a typical day.

50% of the adults completing the series demonstrate adoption of healthy eating practices by reporting an increase in vegetable consumption during a typical day.

30% of the adults completing the series demonstrate adoption of healthy eating practices by reporting a positive change in whole grain consumption during a typical day (e.g., change from never to seldom, seldom to sometimes, sometimes to most times, and most times to always)

29% of adults completing the series demonstrate gains in awareness of healthy eating practices by reporting a positive change in how often they think about healthy food choices when deciding what to feed their family.

Food Resource Management

After the series, participants reported that they would engage in these food resource management behaviors more often than before participating in the series:

57% of adults completing the series demonstrate improvement in one or more food resource management practices (i.e., planning meals, compareing prices, not running out of food, or using grocery lists).

Food Safety

After the series, participants reported that they would often or always engage in these food safety

behaviors:

Adults:

38% of the adults completing the series demonstrate improvement of the food safety practices of thawing and storing foods.

Physical Activity

After the series, participants reported an increase in their physical activity behaviors:

Adults:

25% of adults completing the series demonstrate adoption of increased time spent in physical activity by reporting a positive change in the time spent being physically active on a weekly basis (e.g., changes from sedentary to moderate activity, or to active; and changes from 30 minutes or more of physical activity/day in at least 4 days of the week).

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

Outcome #5

1. Outcome Measures

Number of youth participants with increased knowledge about healthy lifestyles.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	15031

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Situation: Knowing our numbers in Michigan

There is a high level of people living at or below the poverty level; high levels of obesity among adults; and low levels of adults consuming the adequate amount of fruits and vegetables in Michigan. These are factors that affect the quality of life of adults and their families, and increase their likelihood of chronic diseases.

In Michigan, 17.5% were considered below the poverty level in 2011 (US Census Bureau, 2011).

Based on USDA data, 1,784,755 people (18.1%) are receiving Supplemental Nutrition Assistance Program benefits- Bridge Card in Michigan (USDA Food and Nutrition Service, 2013).

Through 2009-2011, 3,855,000 people (14.2%) in Michigan were considered food insecure, and 5.6% of people in Michigan were considered to have very low food security (USDA ERS, 2011).

About 48% of all SNAP participants are in working families (USDA Food and Nutrition Service, 2011), and 22% of those who receive SNAP Benefits in Michigan are adults living with children (USDA Food and Nutrition Service, 2011).

Michigan has the 10th highest prevalence of obesity in the United States (Michigan Department of Community Health, 2011). Three out of every ten (30.3%) adults in Michigan are obese, while approximately 35% of adults are overweight (Michigan Behavioral Risk Factor Survey & Weight Status Among Michigan Adults, 2009). 11.9% of Michigan youth are considered obese (CDC YRBSS, 2009).

In 2009, 77.4% of Michigan adults did not consume adequate amounts of fruits and vegetables (CDC BRFSS, 2009). 20% (1/5) of Michigan youth eat the recommended daily allowance of five servings of fruit and vegetables a day (Michigan Youth Risk Behavior Survey , 2009).

In 2009, the prevalence of inadequate physical activity among Michigan adults was 48% (MiBRFSS, 2009).

23.6% of Michigan?s adults reported that during the past month, they had not participated in any physical activity (CDC, BRFSS, 2009-2010).

In Michigan, only 49.4% of adolescents were physically active for at least 60 minutes/day on 5 or more days (CDC, YRBS, 2011).

According to Michigan Food Safety, the three main causes of foodborne illness are (2009): improper temperatures, poor personal hygiene and cross-contamination of food.

Preventing or managing chronic diseases is the top health challenge of the 21st century. Seven out of 10 deaths each year are from chronic diseases. More than 75% of healthcare spending (in Michigan and the U.S.) is for people with chronic diseases including heart disease, stroke, cancer, diabetes, kidney disease, and dementia. Leading a healthy lifestyle can greatly reduce the risk of developing chronic diseases (Michigan 4 by 4 Wellness Plan).

What has been done

What do we do? Nutrition and Physical Activity Education

Nutrition and physical activity education are means to prevent obesity among adults and to prevent and decrease chronic diseases. Michigan State University (MSU) Extension delivers high-quality and affordable education to serve the needs of children, youth, families and communities in urban, rural and suburban areas.

MSU Extension programming promotes healthy life-styles and educates Michigan residents, allowing each individual to acquire the skills to take control of his or her personal health. The Nutrition & Physical Activity Workgroup (NPA)of the Health and Nutrition Institute of MSUExtension works to improve the knowledge, skills, attitudes and behavior of individuals regarding nutrition and physical activity. Through promotion, planning and delivery, MSU Extension staff members provide education to diverse audiences at the local, county and state

level. Programs aim to help children, youth, adults and seniors incorporate healthy and affordable nutrition choices into their lifestyles while increasing physical activity for an overall increased community well-being.

Through our educational programs, adults learn about MyPyramid and MyPlate; making the most of their food dollars; menu planning; understanding a recipe; keeping food safe; nutrition and health; improving physical activity and feeding a family.

Results
An evaluation found:

Dietary Quality

After the series, participants reported the following changes in the area of dietary quality:

Youth

30% of youth demonstrated adoption of healthy eating habits by improving their intake of fruit servings in a usual day.

36% of youth demonstrated adoption of healthy eating habits by improving their intake of vegetable servings in a usual day.

32% of youth demonstrated adoption of healthy eating habits by decreasing their intake of sugary drinks on a usual day.

34% of youth demonstrated adoption of healthy eating habits by improving their intake of whole grain servings.

Food Safety

After the series, participants reported that they would often or always engage in these food safety behaviors:

Youth:

29% of youth reported increasing their frequency of food safety practices.

Physical Activity

After the series, participants reported an increase in their physical activity behaviors:

Youth:

29% of youth demonstrated adoption of increased time spent in physical activity by reporting a positive change in time spent being physically active on a weekly basis.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
806	Youth Development

Outcome #6

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	651

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research shows that children who receive affection and nurture from their caregivers have the best opportunity for healthy development.

What has been done
One example is a program based on Stephen Bavolek?s evidence-based Nurturing Parenting, where MSUE developed a program for parents, grandparents, childcare providers and others who care for children, ranging from birth to teens. Participants learned what nurturing is and how to be a nurturing parent, enhance positive relationships with children, how to discipline without spanking, methods to handle stress and anger, child growth and development, understanding the brain development of children and teens and how to help build self-esteem. Nurturing Families increased skills that promoted positive family relationships. It was offered as a series, and one-time workshops on specific topics.

Results
Surveys were given at the beginning of the series and at the end of the series. The evaluation results found there was a positive change on all four constructs assessed; Family Functioning and Resiliency, Emotional Supports, Concrete Supports and Nurturing and Attachment.

44% of the participants changed on the extent to which they recognized and responded to their own needs

48% of the participants changed on the extent to which they could identify negative/abusive relationship behaviors

39% of the participants changed on increased social support that helped in their emotional needs

47% of the participants changed on ability to access needed resources at a time of crisis

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being

Outcome #7

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	2176

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Social and emotional health and well-being -- the social, mental, psychological and spiritual aspects of people?s lives across the lifespan -- play a critical role in our overall health. Social and emotional health encompasses forming and maintaining satisfying and healthy relationships, taking another?s perspective, resolving interpersonal conflict, feeling capable and whole, expressing emotions, navigating stress, and having supportive relationships. Social and emotional health also involves having a positive sense of self ? including developing a healthy sense of identity around aspects related to race and ethnicity, gender, sexuality, spirituality and abilities/disabilities. As is true for all aspects of human development, social and emotional health must be addressed across multiple levels, including the personal, interpersonal, institutional and cultural levels.

What has been done

MSU Extension developed the ABC of Bullying Prevention workshop to help youth develop skills to address self esteem, aggressive behavior, and strategies to address bullying.

Results
Evaluation results found:

91% had a greater understanding about different kinds of bullying behaviors and how they can affect all those involved.

89% had a greater understanding about the connections between bullying and human differences based on class, gender, sexual orientation, race, ethnicity, etc.

85% could distinguish between bullying behaviors and harassment behaviors.

93% understood the importance of addressing issues of bullying at multiple levels (personal, interpsonal, institutional, and cultural).

86% developed new skills for interrupting bullying behaviors and for supporting those who are targeted.

87% were aware of more programs and resources for addressing these issues.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
806	Youth Development

Outcome #8

1. Outcome Measures

Number of adult participants with increased knowledge of youth development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	2780

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
One example in this area is helping adults teach youth about science. There is a need to build science literacy on a local and state level. To do so, adults needed to learn not only science curriculum but youth development.

What has been done
Target audience was youth and adult volunteers who attended 4-H Exploration Days from 83 Michigan counties.

Results
Evaluation results found:

For adults:

100% of adult learners indicated increased food science knowledge
100% of adult learners indicated increased understanding about entrepreneurship and career opportunities that youth can pursue in food science related fields.
100% of adult learners indicated that they plan to apply the science knowledge and skills they gained during the workshop.
20% increased in their perception of their knowledgeable in science.
25% increased in their perception of their understanding of how to teach youth using a hands-on learn-by-doing approach.
10% increased in their perception of their ability to teach youth using a hands-on learning- by-doing approach.

For Youth changes regarding science:

10% increased in their perception of their ability to figure out exactly what the problem is.
9% increased in their perception of their ability to determine what caused the problem.
9% increased in their perception of their ability to keep their minds open to different ideas when planning to make a decision.
8% increased in their perception of their ability to easily express their thoughts on a problem.
10% increased in their perception of their ability to compare ideas when thinking about a topic.
9% increased in their perception of their ability to keep their minds open to different ideas when planning to make a decision.
10% increased in their perception of their ability to look for information to help them understand the problem.
9% increased in their perception of their ability to think about all the information they have in order to make choices.
18% increased in their perception of their ability to think of past choices when making new decisions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
806	Youth Development

Outcome #9

1. Outcome Measures

Number of youth participants with increased knowledge of youth development.

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The need to develop economically and environmentally sound approaches to address environmental and natural resources challenges is increasingly important. Policies, practices and science-based knowledge must constantly evolve to promote stewardship and sustainability in light of new opportunities for increased productivity, resource-saving technologies and threats to biodiversity. Research is needed to ensure that practices and policies have a strong, science based foundation.

What has been done
Research to: better understand public benefits for policy development in recreation and tourism resource management; identify sustainable ways to
enhance human well-being while reducing stresses on the environment; and to better understand the current spread, historical distribution and future disease risk of Lyme disease to inform effective citizen-focused information campaigns; better understand the effects of climate on woody seedlings.

Results
Strengthening and sustaining MI's tourism industry and increasing collaboration between state

tourism and agriculture industries, specifically the relationships between tourism, outdoor recreation, natural resources and the environment. Many of these goals were realized through the Michigan Tourism Strategic Plan; 10 presentations and 6 web-based articles and the MTSP website (tourismplan.anr.msu.edu)

Two international and two workshops to discuss the establishment of Wolbachia into maleria mosquito vector and demonstration of its ability to induce cytoplasmic incompatibility. NIH invited our group to submit a proposal.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #11

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1590

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many Michigan families are finding it difficult to make ends meet and sustain daily living. Some of the reasons for this are job loss, decreased income, increased mortgage or rent costs, rising food prices and lack of affordable credit. In order for communities to prosper it is important that individuals and families review their assets and liabilities and develop a plan to change their financial habits for a more sustainable existence. When individuals and families in our communities are financially healthy, it creates an environment for sustained community prosperity.
According to the BLS current population survey (CPS), the unemployment rate for Michigan was 8.7% in June 2013, compared to the national average of 7.6%. There are 408,335 Michigan residents currently unemployed. Foreclosure rates are also troubling in Michigan. A recent 2013 RealtyTrac report on foreclosures ranks Michigan tenth on a list of the top state foreclosure rates.

The filings include default notices, auction sale notices and bank repossessions.
Home ownership rates could also be improved in the state. In Michigan, home ownership dropped from 71.7% in 2000 to 69.2% in 2010 for householders under age 65. That is a decrease of 3.5 percent and it reflects difficulties purchasing or keeping a home under recent economic conditions. Additionally, many Michigan residents struggle to manage their finances. Saving and debt statistics illustrate this challenge:
?Forty-nine percent (49%) of American consumers have difficulty covering monthly expenses.
?Fifty-six percent (56%) do not use a budget to guide spending.
?Forty-four percent (44%) gave themselves a grade of c and lower on their financial knowledge.

MSU Extension has an important role to play in addressing issues of financial health of individuals and families through community-based educational programs. The overarching goal of these efforts is for Michigan consumers to become aware of their personal financial profile, to adopt sound financial practices ? including managing a spending and savings plan and utilizing financial products and services in a beneficial manner and identify goals and the steps necessary to reach self-sufficiency. MSU educational programs also provide Michigan citizens with housing education that better prepares consumers for homeownership and retention of the home as an asset. Homeownership education and counseling has been shown to get buyers into lower-cost mortgages, increase credit scores, reduce defaults, improve borrowers' financial standing and increase the likelihood of troubled borrowers seeking foreclosure prevention assistance.

What has been done
Michigan State University Extension developed a financial literacy program to assist individuals, households, organizations and communities to become sustainable through education related to financial capability, pre-purchase and foreclosure intervention and more.

Results
Evaluation results found:

45% changed in setting SMART Financial Goals
41% changed in keeping track of spending and income
40% changed in reviewing all credit cards bills and statements for accuracy
40% changed in writing out a spending plan
47% changed in saving money regularly
50% changed in obtaining and reviewing credit report annually
24% changed in paying bills on time
38% changed in paying down debt or new credit card charges each month
21% changed in obtaining a housing payment that fits within their budget
53% changed in making choices today that will make retirement a reality
47% conducted a home energy audit through reputable company or service

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

Outcome #12

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As we head into the second decade of the new millennium, paradigms of an unfolding nutrition transition in many countries; and uncontrolled obesity epidemic gripping America; global malnutrition; prolonged food insecurity in many low-income countries; and changes to prevent childhood stunting compel us to more fully understand the developmental (nutritional) origins of health and chronic disease that dominate the global public health nutrition agenda. By studying how individual food components are digested, absorbed, metabolized and utilized - and their effects on genes, cells and organs - the whole person can be understood. Deliberate manipulation of these food interactions can lead to improved health.

What has been done
Research to: identify more effective, efficient and greener, plant-based processes to produce pharmaceuticals; to determine the effect of selected nutrients and food components on the development of allergic airway diseases; and understand genetic and environmental components of M. tuberculosis persistence.

Results
Due to unreliable manufacturing, a recent Taxol shortage caused treatment delay s in patients with breast, ovarian, lung and colon cancers. We used an in vitro enzyme system to produce paclitaxel from baccatin III for the first time using two Taxus acyltransferases and two CoA ligases co-opted from bacteria in only 4 enzymatic steps. We will partner with the Michigan Biotechnology Institute to scale up the process.

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components

723 Hazards to Human Health and Safety

V(H). Planned Program (External Factors)

External factors which affected 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.)

Brief Explanation

The ongoing economic challenges being faced by Michigan -- including the recent federal funding sequestration process -- 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. Although overall research FTEs only decreased by one -- from 65 FTEs to 64 FTEs this past year, we are down from 77.1 FTEs just two years ago.

Specifically, a 15 percent decreases in state funding FY2011-2012 coupled with a flat federal funding line for two consecutive 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 AgBioResearch 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.

These reductions caused some stakeholders to question the commitment of Extension and AgBioResearch to Michigan agriculture. In an effort to address these concerns, leaders from both organizations participated in a series of 13 open forum meetings held throughout Michigan in 2013. Stakeholders and community members asked questions and had the opportunity to learn more about the past decisions and future plans of Extension, AgBioResearch and the MSU College of Agriculture and Natural Resources. It was a valuable exchange between the organizations' leaders and industry stakeholders across Michigan, and helped to ease some tension caused by the cutbacks.

Together, Extension and AgBioResearch continue to serve as the primary research and development arm for the agriculture and food industries in Michigan, valued at more than $91 billion annually.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

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 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.

Addional MSUE Evaluations in this area:

Diabetes Personal Action Toward Health (PATH)

Issue (who cares and why)?

Chronic diseases are among the most prevalent, costly, and preventable of all health issues. Leading a healthy lifestyle greatly reduces a person's risk for developing chronic disease. Access to high-quality and affordable prevention measures are essential to saving lives, reducing disability and lowering costs for medical care.

What has been done

MSUE is positioned to provide education to Michigan citizens related to the prevention and management of leading chronic diseases. One example is Diabetes Personal Action Toward Health (PATH) program. PATH provides the skills and tools to manage chronic health conditions. In Michigan, this is the name for Stanford University's Chronic Disease Self-Management Program. People who participate in PATH workshops are better equipped to face the daily challenges of living with one or more chronic conditions. PATH is a six-week series facilitated by two trained leaders who have chronic conditions themselves. PATH teaches ways to deal with the challenges of not feeling well, talk to healthcare providers and family members, overcome stress and relax, increase energy, handle everyday activities more easily, stay independent and set goals.

Results

Evaluation results found:

· 72% diagnosed with Type 2 diabetes; 14% no diagnosis of diabetes at time of PATH; 5% diagnosed at-risk for developing diabetes; 2% diagnosed Type 1 diabetes; and 7% pre-diabetic.

· 50% self-report being in good or very good health. 4% described their health as

poor.

- Improved self-rated general health 13%
- Decreased discouragement by health problems 30%
- Decreased fearfulness about future health 22%
- Decreased worry in life about health 29%
- Decreased frustration about health problems 31%
- Decreased symptoms of fatigue 34%
- Decreased shortness of breath symptoms 25%
- Decreased pain symptoms 37%
- Increased time stretching or doing strengthening exercises 39%
- Increased time walking for exercise 41%
- Improved confidence to keep the fatigue caused by disease from interfering with life 47%
- Improved confidence to keep physical discomfort or pain from interfering with life 41%
- Improved confidence to keep emotional distress caused by disease from interfering 47%
- Improved confidence to keep any other symptoms or health problems from interfering with life 33%
- Improved confidence to do different tasks and activities needed to manage health to reduce need to see a doctor 49%
- Improved confidence to do things other than just taking medication to reduce how much illness affects everyday life 49%
- Reduced interference with normal social activities with family, friends, neighbors, etc 21%
- Reduced interference with hobbies or recreational activities 27%
- Reduced interference with household chores 23%
- Reduced interference with your errands and shopping 24%
- Increased frequency of preparing a list of questions to ask during a healthcare visit 37%
- Increased frequency of asking questions related to disease and treatment during healthcare visit 38%
- Increased frequency discussing personal problems possibly related to illness during a healthcare visit 39%
- Increased confidence to eat meals every 4 to 5 hours every day, including breakfast every day 29%
- Increased confidence to follow diet when preparing or sharing food with other people who do not have diabetes 44%
- Increased confidence to choose the appropriate foods to eat when hungry 42%
- Increased confidence to exercise 15 to 30 minutes, 4 to 5 times a week 49%
- Increased confidence to do something to prevent blood sugar levels from dropping when exercising 52%
- Increased confidence to know what to do when blood sugar level goes higher/lower than it should 54%
- Increased confidence to judge when changes in illness happen to visit the doctor 47%
- Increased confidence to control diabetes so it does not interfere with life 57%

4-H Life of Lake Superior - TechXcite -Solar Car Challenge

Issue (who cares and why)?

There is a need to build science literacy on a local and state level.

What has been done

MSUE developed and implemented Life of Lake Superior Workshop for 4-H youth. This was an engineering workshop featuring Topic/s: Alternative Energy: Solar Energy Car Challenge**.** Specific Title: 4-H Engineering & Design Challenge: Racing With the Sun from Duke University's TechXcite curriculum (2012). Additionally, handouts and other materials were adapted from the National 4-H Robotics curriculum, specifically; the characteristics of an engineer (see attached description of Chiodini's Life of Lake Superior Lesson Planning Notes).

Results

Evaluation results found:

- 44% of youth learners participating in the TechXcite Solar Car Challenge indicated that they would like to be a scientist or an engineer when they grow up.
- 75% of youth learners indicated that they feel more knowledgeable about solar/alternative energy after the Challenge.
- 67% of youth learners indicated that they feel more knowledgeable about entrepreneurship and career opportunities that youth can pursue in engineering/design or science related fields.
- 66% of youth learners indicated that they plan to apply the science knowledge and skills they gained at the Challenge.
- 87% of youth learners indicated that engineering requires specific knowledge and skills above and beyond just training in the engineering field.
- 87% of youth learners indicated that engineers need to be well rounded and understand the social context of their issue, including history, economics, and environment relating to the engineering problem.
- 95% of youth learners indicated that engineers need to understand the importance of teamwork and the ability to work with others.

Breakfast on the Farm

Issue (who cares and why)?

Many consumers have lost the connection between agriculture and food systems in the community. This connection can have many implications on supporting farmers to buying local food.

What has been done

MSU Extension developed Breakfast on the Farm that provides consumers with a first-hand look at modern agriculture.

Results

Evaluation results found:

Exit surveys continue to show that for approximately 43% of the visitors, the experience is the first time they have been on a farm in twenty years or more. In 2012, participants attending BOTF at one of 7 dairy farms were invited to participate in a follow-up electronic survey approximately 6 months after the events. The survey tool was designed, in part, to see if the BOTF experience resulted in changing the purchasing behaviors of the participants.
Follow up electronic survey approximately 6 months after participants visited a Breakfast on the Farm event held on a Michigan dairy farm was conducted

Results/Impact: 244 individuals completed the survey. Data indicates a 9.3% increase in the percentage of dairy products purchased per household following the visit to one of the dairy farms hosting Breakfast on the Farm. Based on the total number of respondents, data showed weekly household purchases of milk, cheese and yogurt increased by 2 gallons for milk, 2 pounds (cheese) and .33 units of yogurt. Using these figures and average retail prices, the overall change in dollars spend on Michigan sourced milk, cheese and yogurt for households (96) attending 2013 BOTF events equates to $426,377.

Key Items of Evaluation

MSU scientists are using funding from the National Institute of Environmental Health Sciences (NIEHS)
to continue research on understanding the health risks from chemicals -- primarily dioxins -- commonly found at the sites. Research focuses on remediation technologies to eliminate the potential for
exposure to chemicals at the sites. They are trying to use different mouse strains to model human genetic diversity. We hope the results will give risk assessors an accurate way of calculating the risk of
exposure for people who live or work near Superfund sites and ultimately show ways to minimize that risk.

Another project is looking at Fat accumulation in the liver. The chronic accumulation of fat in the liver
can progress into more complex diseases such as nonalcoholic fatty liver disease
and metabolic syndrome, which have been associated with diseases such as diabetes,
obesity, cardiovascular disease and liver cancer. So far, we have found that dioxins work
through a specific protein called the aryl hydrocarbon receptor to increase liver fat accumulation
using fat from the food we eat. We believe that's what is creating the problem. Researchers are also trying to discover whether the response in mice is relevant to humans and whether it can be a contributing factor in
the increased incidences of liver cancer, diabetes and cardiovascular disease.

Preparing Michigan's Children and Youth for the Future Institute

Indicator
Reported
# of adults that increase knowledge and skills in early childhood content areas
346
# of caregivers , community partners, and families that are aware of MSUE early childhood resources and opportunities
331
Number indicating the ability to apply science knowledge
593
# of youth who attend post-secondary education
1,568
# of adults who increase knowledge and skills in science content areas
167
# of adults who indicate increased confidence in their ability to engage youth in experiential, inquiry based science learning
147
# of community partners, educators, and families that are aware of MSUE 4-H science resources and opportunities for youth.
424
Number of youth participating in programs who report an increase in science knowledge.
761
Number of participating youth indicating the ability to apply problem solving, critical thinking, and decision-making life skills.
1,973
# of youth indicating the ability to apply the use of life skills gained through participation in 4-H.
2,316
# of Michigan youth who apply life skills learned in their daily lives.
1,964
Number of youth participating in programs who report an increase in problem solving, critical thinking, and decision-making life skills.
439
# of youth participants able to identify life skills they have gained through their 4-H experiences.
1,916
#of adult participants who can identify the connection between 4-H participation, life skills development, and academic success.
281
# of community partners, educators and families that are aware of MSUE CYI life skills resources and opportunities for youth.
563
Number of participants indicating an increase in knowledge, skills, or confidence by using facilitative processes, conflict management skills, or civic participation practices
331
Number of participants who report that they are better prepared to make a change in their community or organization as a result of the training provided by MSUE
231

Number of youth that demonstrate the skills necessary for leadership.
243
Number of youth that gain knowledge and skills necessary for leadership.
563
Number of adults that gain knowledge and skills necessary for leadership.
212
Number of youth that gain understanding of Youth/Adult partnerships.
96
Number of youth participants that set a goal for their career or job.
1,590
Number of youth participants that gain self-awareness as it relates to future career possibilities.
1,537
Number of youth who indicate an increase in knowledge of financial concepts.
146
Number of youth participants that learn about the basic skills necessary for employment.
128
Number of youth that apply global and cultural competencies.
3,672
Number of youth that are culturally and globally competent leaders and citizens.
3,672
Number of youth that gain knowledge and skills in global and cultural competencies.
3,707
# of adults indicating the ability to apply knowledge to engage youth in experiential, inquiry based science learning.
234
# of adults indicating the ability to apply life skills education into their youth development programs and activities.
237
Number of volunteers that incorporate appropriate quality standards for positive youth development into their programming.
151
Number of communities/counties in Michigan that have systems in place to support the development of assets and life skills in youth.
54
Number of new volunteers that gain knowledge about quality standards for positive youth development.
372
Number of new professionals that gain knowledge about quality standards for positive youth development.
112

Improving Health and Nutrition Institute

Indicator
Reported
Number of participants who correctly answer 75% of the end of session questions
425

Number of participants that implement 2 actions related to a safe food environment
207
Number of participants that pass a national exam
440
Number of participants that increase safe food handling practices such as proper and frequent hand washing, improved kitchen cleanliness, cooking food adequately, avoidance of cross contamination, keeping foods at safe temperatures, avoidance of foods from unsafe sources.
646
Number of participants that follow USDA food preservation guidelines including freezing, dehydrating, proper processing techniques for low and high acid foods, using correcting processing times and using tested recipes for preserving foods,
805
Number of participants that gain knowledge in the proper process for hand washing and personal hygiene
558
Number of participants that gain knowledge in cross- contamination
636
Number of participants that gain knowledge in safe temperatures for cold and hot foods/cooling hot foods and storing temperatures
674
Number of participants that gain knowledge in preserving foods including canning methods for low and high acid foods and methods for freezing and dehydrating foods.
825
Number of participants with improved awareness, knowledge, and skills of personal hygiene (such as hand washing), cooking and storing food adequately, and avoidance of cross contamination, keeping foods at safe temperatures, and avoidance of foods from unsafe sources.
670
Number of participants with improved knowledge and awareness of the importance of following USDA food preservation guidelines including proper processing of low acid and high acid foods, correct processing times, selection of food for preservation, using tested recipes, freezing & dehydrating foods.
834
Number of adults completing the series demonstrate adoption of healthy eating practices by reporting an increase in fruits consumption during a typical day
2,755
Number of adults completing the series demonstrate adoption of healthy eating practices by reporting an increase in vegetable consumption during a typical day
3,160
Number of adults completing the series demonstrate adoption of healthy eating practices by reporting a positive change in whole grains consumption during a typical day (e.g., change from never to seldom, seldom to sometimes, sometime to most times, and most times to always)-V1
2,123
Number of adults completing the series demonstrate gains in awareness of healthy eating practices by reporting a positive change in how often they think about healthy food choices when deciding what to feed their family.
1,865
Number of adults completing the series demonstrate adoption of healthy habits by reporting a positive change in the time spent being physically active on a weekly basis.

1,815
Number of adults completing the series demonstrate adoption of healthy eating practices by reporting a positive change in exit intake nearer recommended amount with regards to age, sex, and level of physical activity
5,707
Number of adults completing the series demonstrate improvement in one or more food resource management practices (i.e., plans meals, compares prices, does not run out of food, or uses grocery lists).
3,341
Number of the adults completing the series demonstrate improvement of the food safety practices of thawing and storing foods.
2,496
Number of youth demonstrate adoption of healthy eating by improving intake of fruit servings in a usual day.
3,504
Number of youth completing the series will demonstrate an increase in the knowledge necessary to identify food groups.
1,181
Number of youth demonstrate adoption of healthy eating by decreasing intake of sugary drinks.
829
Number of youth demonstrate adoption of healthy eating by improving intake of vegetable servings.
2,573
Number of youth demonstrate adoption of healthy eating by improving intake of whole grains servings.
871
Number of youth completing the series demonstrate adoption of increased time spent in physical activity by reporting a positive change in the time spent being physically active on a weekly basis.
3,084
Number of youth report increasing frequency of food safety practices.
2,790
Number of adults demonstrate adoption of increased time spent partially and exclusively breastfeeding.
1,008
Number of Adults demonstrate adoption of increased initiation of breastfeeding.
568

Greening Institute

Indicator
Reported
Number of participants that keep track of spending and income by creating a personal budget.
236
Number of participants that save money regularly by spending less than is earned
259

Number of participants that obtain, review and correct their personal credit report.
256
Number of participants that pay bills on time.
241
Number of participants that pay down debt and adopt behavior change that improves their credit score.
238
FNumber of participants that plan for retirement
124
Number of participants that can calculate a reasonable housing cost based on the household budget.
209
Number of participants that conduct a home energy audit.
180
Number of participants that can identify SMART financial goals.
234
Number of participants that increase awareness of income, saving and spending through tracking
221
Number of participants that learn to review all bills and/or financial institution statements for accuracy.
220
Number of participants that increase their knowledge of home ownership financial requirements.
190
Number of participants that increase their knowledge in predatory lending.
183
Number of participants that learn foreclosure options - keep, sell or foreclose.
169
Number of adult and youth participants who access MNFI, DNR and DEQ data.
115
Number of adult and youth participants who indicate they know how to access needed information.
121
Number of adult and youth participants who implement a practice to mitigate an ecosystem threat.
1,550
Number of participants who initiate or contribute to ecosystem-related planning in their local area.
18
Number of adult and youth participants who indicate a high or very high awareness of human impacts on ecosystems and ecosystem health.
8
Number of adult and youth participants who indicate their awareness of human impacts, such as exotic invasive species, habitat damage or non-point source pollution.
53
Number of adult and youth participants who indicate high or very high confidence in their ability to address an ecosystem threat.
8
Fostering: Number of local ordinances amended to accommodate economic development, placemaking, form based coding, Firewise provisions, and other similar measures

16
Number of youth program participants who increase involvement in community issues.
12
Fostering: Number of community leaders with increased awareness and skills in global or new economy (such as but not limited to placemaking, entrepreneur-friendly, regionalism, and so on).
25
Fostering: Number of community leaders with increased awareness and skills in measures to prevent damage from wild fire and local regulation to deal with wildfire issues.
62
Number of youth program participants who increase knowledge on tribal, state, and local government.
12
Governance: Number of boards who have adopted new or improved rules or processes for compliance
13
Governance: Number of participants that report their board used new skills or techniques to improve the effectiveness of their meetings and/or processes at the local or regional level.
184
Governance: Number of boards who implement improved citizen engagement strategies.
53
Number of boards who report improved use of data and relevant information to inform their decision making
31
Number of participants who show understanding of relevant laws and the practical impacts of those laws on their boards
233
Number of participants who increase knowledge of their board's structure, functions and duties, and/or operational best practices
394
Number of participants who increase their knowledge of citizen input processes and /or methods to implement those practices
47
Number of participants who can identify and locate resources for quality information and/or apply that information to the solution of problems
151
Number of producers selling at local/regional markets
10
Number of new enterprizes/locals that purchase local/regional food
23
Number of vendors, farm markets, road side stands that accept Bridge Cards, Project Fresh, and participate in Double Up Food Bucks.
20
Number of new diversifying/expanded agri-food businesses developed
46
Number of Community Food Assessments Completed. Gaps in local food system are identified. This helps guide local food work.
2
Number of people with increased knowledge of community food systems. (measured by a quiz and a specific score means knowledge gain. (Short term.)
1,357

Number of people that have an increase in awareness of the goals of the Michigan Good Food Charter.
983
Number of Sea Grant facilitated curricula adopted by formal and informal educators.
140
Number of people engaged in Sea Grant supported informal education programs.
3,430
Number of acres of coastal habitat protected, enhanced or restored as a result of Sea Grant's activities.
1,051
Number of people or organizations who reported utilizing the tools
44

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Soil, Water and Natural Resources

☑ Reporting on this Program

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%		15%	
102	Soil, Plant, Water, Nutrient Relationships	20%		12%	
111	Conservation and Efficient Use of Water	10%		12%	
112	Watershed Protection and Management	15%		10%	
123	Management and Sustainability of Forest Resources	5%		5%	
131	Alternative Uses of Land	15%		6%	
132	Weather and Climate	4%		10%	
133	Pollution Prevention and Mitigation	10%		12%	
134	Outdoor Recreation	0%		1%	
135	Aquatic and Terrestrial Wildlife	5%		12%	
216	Integrated Pest Management Systems	5%		5%	
806	Youth Development	10%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	26.8	0.0	8.0	0.0
Actual Paid Professional	16.0	0.0	12.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
660646	0	970666	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
660646	0	1008021	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	4582768	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

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. Brief description of the target audience

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

3. How was eXtension used?

eXtension was a major part of our multi-state effort (along with work with the North Central Region). In this area, 25 educators responded to Ask an Expert on 636 issues. A example is:

Members were activiely involved the following Communities of Practice (CoP) for this area:

Climate, Forests and Woodlands
eXtension Wildfire Information Network
Freshwater Aquaculture
Pesticide Environmental Stewardship
Urban Forestry and Energy Conservation
Water Conservation for Lawn and Landscape
Wildlife Damage Management

An example in this area is:

Timing of soil test

Hello, I recently moved into a house with an established garden space. I plan to add compost in the spring before planting my vegetable garden. Would I get the most benefit from soil testing before adding compost or after? How long after composting should I wait to test, if that is the best time?

Reply

The best time to get a soil test is in the spring when you can actually dig it up. Add compost after getting the soil test. The only thing that compost is going to really change is the percentage of organic matter in the soil.

Your ideal soil pH is going to be 6.5...which is somewhat acidic. The percentage of organic matter should be 5% or somewhat more. Your addition of compost is not going to add appreciably to the nutrients in the soil. Numbers will be modest but the addition of organic matter is desirable for every soil except organic soil...it makes sense.

You want to get the soil test packed and shipped when the ground thaws. But at that time, the soil will be too wet to be tilling or mixing in organic matter. You do not want to compact the soil by doing anything with it while it is too wet and can be compacted. You and a shovel will do little compacting but you and a rototiller or a tractor and plow is lots of squishing and squashing.

Wait until you can take a handful of soil and compress it into a ball and then poke it with your finger and have it fall apart. The more clay, the longer you will have to wait. You would like to add a total of four inches of compost or composted manure. Add two, till in and add the final two. It should be turned into a depth of eight or ideally 12 inches.

If you need the website for buying a test: www.msusoiltest.com

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	3928	11784	14089	42267

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2013
Actual: 2

Patents listed
MICL01884 - Soil Aggregate Porosity Contributions to Carbon Sequestration - (13/791,304)4/12/2013;
MICL01894 - Intraspecific chemical communication of fish - (61/828,001) 5/28/2013

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	2	32	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research programs on soil, water and natural resources.

Year	Actual
2013	49

Output #2

Output Measure

- Number of adult participants trained in soil, plant, water and nutrient relationships.

Year	Actual

2013	1587

Output #3

Output Measure

- Number of adult participants trained in watershed protection and management.

Year	Actual
2013	1394

Output #4

Output Measure

- Number of youth participants trained in watershed protection and management.

Year	Actual
2013	12427

Output #5

Output Measure

- Number of adult participants trained in management and sustainability of forest resources. Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of adult participants trained in alternative uses of land.

Year	Actual
2013	947

Output #7

Output Measure

- Number of youth participants trained in alternative uses of land.

Year	Actual
2013	1662

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 watershed protection and management.
3	Number of youth participants with increased knowledge of watershed protection and management.
4	Number of adult participants with increased knowledge in management and sustainability of forest resources.
5	Number of research programs to determine how wildlife responds to ecosystem management decisions in natural resource and agricultural systems.
6	Number of adult participants with increased knowledge of alternative uses of land.
7	Number of adult participants with increased knowledge of soil, plant, water and nutrient relationships.
8	Number of research programs that deal with fish population dynamics and the management of Great Lakes fisheries.
9	Number of research programs that deal with the security, stewardship and management of Michigan's water resources.
10	Number of research programs that analyze key soil characteristics to better assess their agricultural and environmental contribution, including crop yield.
11	Number of research programs that explore the occurrence, transport and fate/effect of organic contaminants, chemicals, pesticides, pharmaceuticals and particulates in soils.
12	Number of research programs to develop new land use models for Michigan communities.

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Soils constitute a huge reservoir of microbes, whose activities have a profound impact on crop productivity, soil fertility and biogeochemistry. However, knowledge of the composition, organization and fluctuations of indigenous microbial populations in soil ecosystems is scarce, even though metabolism of such microbes drives many ecosystem level processes.

What has been done
Research to: understand temporal and spatial control of gene expression during development of soil bacteria; determine how well the most promising candidate strains of cereal-adapted rhizobia perform as superior biofertilizer innoculants for rice and wheat when scaled up to full-size farmer plots; investigate novel cultivation strategies and cultivation-independent techniques to advance our understanding of microbes and microbial communities in soils; and develop new technologies to control soil-borne diseases.

Results
During the past year, we conducted basic research on the endosporulation process of B. subtilis and on the multicellular developmental process of M. xanthus. Our studies of B. subtilis endosporulation generated new fundamental knowledge. Upon starvation, B. subtilis undergoes a developmental process involving creation of two cell types, the mother cell and forespore. A signal in the form of a serine protease is secreted from the forespore and leads to regulated intramembrane proteolysis (RIP) of Pro-sigK, releasing active SigK into the mother cell. RIP of Pro-sigK is carried out by a membrane-embedded metalloprotease, SpoIVFB, which is similar to intramembrane-cleaving proteases of the site-2 protease family. These proteases are components of important signaling pathways in diverse organisms. Using coexpression in E. coli, we identified features of SpoIVFB and Pro-sigK that are important for RIP. Our studies of C-signaling during M. xanthus development are establishing a new paradigm for how bacterial cells interact and regulate genes during biofilm development. C-signaling involves CsgA, a protein that

mediates short-range signaling between cells, regulating cell movements, gene expression and sporulation. To understand how C-signaling regulates gene expression, we identified two transcription factors that bind cooperatively to the promoter regions of several C-signaldependent genes. We found that this combination of unusual transcription factors binds cooperatively to the promoter regions of several C-signal-dependent genes, and their arrangement is variable. We hypothesized that FruA communicates positional information via short-range C-signaling and MrpC communicates persistent starvation, and that this combination of signals governs commitment to sporulation. This hypothesis predicts that the MrpC concentration in developing cells should be sensitive to nutrient addition, and this was shown to be the case.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships

Outcome #2

1. Outcome Measures

Number of adult participants with increased knowledge of watershed protection and management.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1254

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Michigan has over 11,000 inland lakes which provide essential habitat for fish and wildlife. Due to the vast number of lakes, and lack of staff from state agencies, stewardship of lakes and Michigan's diverse natural resources falls to its citizens. Educational efforts are critical to educate lakefront property owners on natural erosion control methods and the use of natural materials and native vegetation along the shoreline to provide erosion control and habitat value while maintaining the aesthetic value of the lakefront.

What has been done
One example is where MSUE partnered with organizations that reflected the diverse state and local entities that are integrally involved in providing education and technical assistance to those working at the shoreline. Partners included Clinton River Watershed Council, several certified

natural shoreline professional contractor, Oakland County Water Resource Commissioner's office, Oakland County Parks, Oakland Conservation District, Michigan Department of Environmental Quality, Michigan Native Plant Producers Association and MSU Extension. This natural shoreline workshop, geared toward homeowners, was held on March 16, 2013 and was attended by a diverse audience of individuals residing in 7 different counties (Oakland, Wayne, Ingham, Macomb, Shiawassee, Livingston, and Berrien).

Results
An evaluation of this program found:

87% of participants in the pre-test indicated they had no or some knowledge accessing information on natural shorelines. Post-test results showed 98% of individuals indicated they were knowledgeable or very knowledgeable as a result of participating in the program.

87% of pre-survey respondants indicated they had little or some knowledge about healthy lake ecosystems, vs. 96% post-survey who were knowledgeable or very knowledgeable.

78% of pre-respondants idicated they had some knowledge vs. 94% in the post-survey who were knowledgeable or very knowledgeabele.

65% described their confidence in understanding the steps needed to create a natural shoreline landscape as high or very high compared with 93% post-workshop who said they were knowledgeable or very knowledgeable.

90% described their confidece in understanding the steps needed to implement bioengineered shoreline erosoion control as medium or high.

100% planned to share information from the workshop with others.

Changes participants planned to make in their shoreline:

20- stop mowing to the water's edge to the way you manage shoreline to protect water quality
17- stop fertilizing to the water's edge
31- let some aquatic and emergent palnts grow at the shoreline area rather than remove them.
30- install a vegetative buffer on land between their mowed lawn and the shoreline
24-install vegetative buffer that extends from the shoreline edge into the water.
12- Add rock rip rap at the shoreline area.
28- change the palnts growing at the shoreline to native plants.
12- install soft-armoring (bioengineering) for erosion control
20- look into other options besides hard armoring (such as installing a seawall) for proteting the shoreline.
15- Hire a contractor to design/install a project to help protect the shoreline.

The biggest obstacle to implementing practices discussed was financial-related.

83% of participants indicated an interest in attending a tour of local natural shoreline projects.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

Outcome #3

1. **Outcome Measures**

Number of youth participants with increased knowledge of watershed protection and management.

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

Number of adult participants with increased knowledge in management and sustainability of forest resources.

Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

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

2. **Associated Institution Types**

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A better understanding of wildlife-habitat relationships as influenced by natural and human wildlife habitat disturbances is needed in order to make more effective natural resources management decisions to sustain biodiversity and conserve wildlife populations, communities and habitat.

What has been done
Research to: understand the mechanisms of wildlife dynamics on landscape mosaics; develop a better understanding of wildlife-habitat relationships as influenced by natural and managed wildlife habitat disturbances; and uncover systematically informative morphological and molecular

characteristics related to arthropods in order to revise classifications and test evolutionary hypotheses.

Results
Through cooperative work with the US Fish and Wildlife Service (USFWS), they now have a better understanding of the influences of how white-tailed deer browsing and foraging in wetland plant and forest habitats types are impacting plant community composition and structure. In addition, because of the lack of statically significant browsing and foraging effects, the USFWS plans to continue using their current deer harvest strategies to provide recreational opportunities as well as to minimize browsing and foraging effects.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife

Outcome #6

1. Outcome Measures

Number of adult participants with increased knowledge of alternative uses of land.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1428

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

One example, stormwater continues to be a major problem in Southeast Michigan. It is estimated that approximately 75.5% of the land area of Oakland (~ 18.2%), Macomb (~ 21.2%), and Wayne (~ 36.1%) counties are covered by impervious surfaces which contribute to stormwater runoff through reduced infiltration on site. Many of these impervious surfaces cannot be changed, such as roads, sidewalks and roofs. However, areas can be adapted around these surfaces to increase the holding and infiltration capacity and reduce runoff.

The development and implementation of educational programs throughout District #11 (Macomb, Oakland, Wayne Counties) will increase and heighten knowledge about the stormwater runoff issue and introduce ways to reduce runoff. They will also encourage individuals and municipalities to adopt practices that improve water quality by preventing erosion, reduce flooding, saving water, and providing habitat to address this issue. Low impact development (LID) techniques that will be discussed include creating rain gardens, buffers and other landscape features utilizing native plants that can be used to collect and treat stormwater.

What has been done

MSUE delivered to Master Gardener volunteers who would potentially share this information with other volunteers in their communities.

Results

Evaluation results found 85% to 95% increased their knowledge on one or more topics in presentation with 95% increasing their knowledge about point and non-point sources of pollution. Topics that most participants indicated they learned more about were watersheds, stormwater basics, bioretention concepts and point/non-point pollution.

Two topics they would have liked more information about were rain garden plants and bioretention.

81% plan to implement one or more concepts they heard about in the program, such as rain gardens (6), rain barrels (3), buffer zones (3), bioswales (2) and native plants (2).

66.6% indicated they will share program information with other, including family, co-workers. One said she would discuss with her school about possibility of installing a rain garden. Another 14% said they might share the information with others.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships

Outcome #8

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	8

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Urban, industrial and agricultural development have caused remarkable changes in the lakes' flora and fauna and fauna associated habitats over the past 200 years. Today, the lakes have aquatic communities that are structurally and functionally volatile and exhibit rapid changes in species number and abundance. Successful fish management of the Great Lakes is now actively focused on the lakes as ecosystems.

What has been done
Research to: investigate areas of uncertainty for Great Lakes fishery management, particularly sea lamprey control and salmon stocking; determine how fish population dynamics are affected by the physical, chemical and biological environment; investigate how human activities bring about changes in aquatic habitats; develop models capable of predicting response of fish to habitat alteration; investigate the environmental effects on fish genetic diversity.

Results
Evaluated the impact of a rock ramp structure on the summer fish assemblage of a Michigan stream. We found that the rock ramp appears to allow sufficient movement to allow the fish community above and below the structure to mix sufficiently to achieve a community structure similar to that of an undammed river.

Studies conducted this year focused on the pheromones that lure females to male nests, which has been our focus on the last five years, we have started to characterize pheromone released by larval sea lamprey. We have made progress in characterizing both adult and larval pheromones, including identification of structures and elucidation of their functions. We have participated in large-scale field applications of pheromone release to test its efficacy as part of the sea lamprey control management.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
134	Outdoor Recreation
135	Aquatic and Terrestrial Wildlife

Outcome #9

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	13

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With growing concern about the connection between health and the marine environment, there is a corresponding emphasis on large freshwater lake ecosystems and human health. The Great Lakes serve as a highway for international maritime commerce and support a $1 billion per year recreational and commercial fishing industry. They also supply drinking water for more than 15 million people. Holding about 20 percent of the world's fresh surface water, the degradation of the Great Lakes ecosystem through chemical and biological contamination presents an enormous challenge for the future.

What has been done
Research to: enhance the current water resources management structure through the ecosystems approach, development of a system to help create sustainable water resource management, understand how anthropogenic actions can affect food web structure and function, address critical questions that have relevance to specific problems in Michigan inland lake and Great Lakes integrity; help develop dynamic, interactive computer interfaces in resource-based recreation management; construct and evaluate a knowledge management system in resource-based recreation management; develop a landscape-based ecosystem management framework that integrates landscape ecology with natural resource policy and management; determine why sport fish populations, fish assemblages and lake food webs, and their response to perturbation vary among lakes; determine if pheromones can be used to control sea lamprey in streams, with a view to developing a viable new control strategy; and to improve design of engineered phytoecosystems for treatment of wastewaters and stormwaters.

Results
Developed new methodology to analyze the field survey data on the position of different zooplankton density as s function of Bythotrephes density and other environmental factors. We are exploring with models and survey data how differential effects of Bythotrephes on different

prey. We further developed multilinear regression (MLR) approach, and developed structural equation modeling (SEM) and partial-least squares regression (PLSR). Correlative analysis between species responses were also performed. Further, we used an optimization model to predict expected responses of different prey to predators based on previous predation experimental results.

Large wildfires are mainly driven by natural factors including fuel availability, temperature, precipitation, wind, humidity, the location of lightning strikes, and anthropogenic factors. In particular, favorable meteorological conditions such as lower atmospheric dryness and instability can contribute to erratic and extreme fire behavior, thus increasing the risk of losing containment of a fire, which may result in catastrophic damage and property loss. Global climate change may have a significant impact on these factors, thus affecting potential wildfire activity across many parts of the world. The work we conducted attempts to understand whether future climate and its manifestation in regional weather patterns would provide more favorable atmospheric conditions for large and dangerous fires. Our findings suggest that despite some differences among the projections by climate models, future lower atmospheric conditions may be conducive to larger and more extreme fires in most regions of the United States, which together with a lengthening fire season suggested by previous studies, poses an additional challenge to fire and forest management.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Understanding the variability of soil and landscape properties and their effect on crop yield is a critical component of site-specific agricultural and environmental management systems. This includes factors such as nitrogen management, soil absorption and environmental interactions.

What has been done
Research to: study herbivore suppression of cyanobacteria and total phytoplankton biomass; effectiveness of nitrogen rates on soil quality and plant nutrition; study the characteristics of high content soil blends used in athletic fields and golf putting greens and how the properties of these soils change with time and use; and to explore diversification with cover crops to enhance nutrient cycling efficiency and rhizosphere traits for resilient, productive row crop systems.

Results
We studied aggregates from the top (A) horizon of conventionally tilled (CT) and no-till (NT) corn?soybean?wheat rotations and native succession vegetation (NS) treatments at NSF Long-Term Ecological Research site, southwest Michigan. The results confirmed that E. coli movement in soil aggregates was mainly driven by water flow via capillary forces. E. coli redistribution was most pronounced
in CT aggregates, followed by NT, and was almost negligible in NS aggregates. Additional bacterial studies of Sphingobacterium spp. Significantly increased erosive strength of stable aggregates while Flavobacterium spp. reduced erosive strength of native soil aggregates by contributing to greater losses of organic carbon from cold soils.

We evaluates nitrogen availability to assess synchrony between supply and demand as a means to reduce nitrogen losses in corn-based production systems. A rye cover crop is proving to be a practical technology that can be established in the fall after corn is harvested. It is effective at reducing nitrogen loss in continuous corn, as well as in corn-corn-soybean rotation sequences, which are becoming more common due to market forces. Soil nitrogen dynamics were monitored at multiple positions within and between rows, which provided evidence of enhanced synchrony in the conservation tillage system. That is, soil nitrogen release and plant demand were congruent in this system. Similar findings were observed at an Illinois site where this trial is replicated. This provides an environmentally-sound and potentially profitable basis for a nitrogen conserving production system.

4. Associated Knowledge Areas

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

Outcome #11

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	8

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Michigan's 37 million acres of land support the plants and animals that provide our shelter, food and fiber. The land provides us with minerals and foods for our industry and our businesses. At the same time, human activities are generating and releasing large amounts of pollutants -- including pesticides, antibiotics and dioxins, and other industrial emissions -- that may end up in the soil. Research to investigate the fate and effect of these pollutants is critical to sustaining soil viability and health, and minimizing consequences to human health.

What has been done
Research to: investigate the transport of a group of engineered nanomaterials in the soil and water environments and develop an understanding of their interactions with other elements; evaluate the occurrence and human health risks of historic pesticide contamination of agricultural soils; understand the mechanisms by which chronic estrogen exposure brings about reproductive failure; determine the mechanistic functions and contributions of soil humus and clays to the immobilization of pesticides and POPs found in soils; evaluate the occurrence of antibiotics in animal farms and their mobility; and to control and convert rural waste to resources.

Results
Consideration of soil organic matter and clays as sorptive phases for pesticides in soils will allow development of better pesticide fate and transport models. Polychlorinated dioxins, especially octachlorodioxin and the highly toxic 2,3,7,8- tetrachlorodioxin, are found at inexplicably high levels even in "pristine" rural and agricultural soils, but their origins are unknown. The potential for clay-mediated in-situ formation of dioxins has important implications for past, present and future contamination of rural soils.

Researchers tested over 350 biomass blends, including animal manures and food processing wastes. This activity contributes to the objective of understanding the digestibility of blended

feedstock to help realize increased positive byproduct production (methane) and stable operations. Results include data on the percentage of methane produced and the amount of COD and volatile solids reduction. Future
tasks entail interpreting this data and developing "rules of thumb" on the best combinations of wastes. Results will help understand the fundamental relationships between feedstocks and aid in determining if further consideration for establishing a renewable energy system is warranted for a specific waste blend. Optimized blends will help in the establishment of successful digesters that will enhance environmental protection, nutrient management, and the production of renewable energy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
132	Weather and Climate
133	Pollution Prevention and Mitigation

Outcome #12

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
What we do to our land is intimately tied to our drinking water quality, wildlife habitat, potential for flooding, our recreational open space and tourism, and many other quality of life issues. For example, urbanization of the rural landscape is claiming some of the country's richest farmland and creating challenges for areas where rural and urban interests collide. Some recipients indicate the, by 2020, farmers will only have enough land to meet the nation's domestic food

needs.

What has been done
Research to: better understand how regional and continental processes affect local processes; increase management capacities among agencies to better integrate biological and human dimensions of management in dealing with wicked problems, such as wildlife health; and to help develop sustainable agro-ecosystems that protect public health, environmental quality and promote efficient and profitable resource use.

Results
Eight large-scale research/demonstration sites in geographically diverse areas of Michigan were established to evaluate innovative, low-disturbance tillage and cover crop establishment methods in diverse cropping systems. The crosscutting objective to is develop and implement cropping system alternatives that build soil quality and are socially, economically and environmentally sustainable. Guidelines were developed and presented to farmers, agribusiness, technical service providers, state and regulatory personnel regarding the effect of cover crop/manure interactions on selecting successful cover crop mixtures. The economics of transporting and land applying liquid manure were evaluated and presented to livestock producers and custom manure applicators. Low-disturbance, vertical tillage operations were evaluated for effects on crop yield, rate of corn residue decomposition, crop emergence, final plant stand and impact on slug populations at planting time. Growers were concerned that GMO corn hybrides were resistant to breakdown and decomposition and high-yielding corn residue was creating planting difficulties in the subsequent crops. The results of the work are being compiled and will be presented to the target audience over the coming months. There was no difference in soybean yield due to vertical tillage either in the fall or in the spring prior to planting. There was no detectable difference in corn residue decomposition between insect resistant hybrids and the non-resistant isoline, however, there was more rapid emergence of the following soybean crop in the tilled ground compared to the no-till ground. Spring tillage was more effective at reducing the volume of corn residue at planting time than fall tillage. There was no detectable difference in slug activity due to tillage operations. Three, large-scale demonstration projects were established, one in St. Joseph Co., one in Calhoun Co., and one in Midland Co. MI to evaluate cropping system impacts on soil quality and demonstrate innovative techniques for cover crop establishment and impacts on soil quality. A project was initiated to evaluate changes in resource use, economics and environmental impacts in the transition from small-scale confinement dairies to seasonal and annual pasture-based production systems.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected 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.)

Brief Explanation

The ongoing economic challenges being faced by Michigan -- including the recent federal funding sequestration process -- 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. Although overall research FTEs only decreased by one -- from 65 FTEs to 64 FTEs this past year, we are down from 77.1 FTEs just two years ago.
Specifically, a 15 percent decreases in state funding FY2011-2012 coupled with a flat federal funding line for two consecutive 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 AgBioResearch 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.

These reductions caused some stakeholders to question the commitment of Extension and AgBioResearch to Michigan agriculture. In an effort to address these concerns, leaders from both organizations participated in a series of 13 open forum meetings held throughout Michigan in 2013. Stakeholders and community members asked questions and had the opportunity to learn more about the past decisions and future plans of Extension, AgBioResearch and the MSU College of Agriculture and Natural Resources. It was a valuable exchange between the organizations' leaders and industry stakeholders across Michigan, and helped to ease some tension caused by the cutbacks.

Together, Extension and AgBioResearch continue to serve as the primary research and development arm for the agriculture and food industries in Michigan, valued at more than $91 billion annually.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

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 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.

That said, the most notable qualitative impacts realized in this program were:

Additional evaluation results for MSU Extension are:

Firewise

Issue (who cares and why)?

Michigan experiences 8-10,000 wildfire annually. While many of these are small in size and able to be contained blocal fire fighting personnel without significant damage, others are large, dangerous, costly to contain and result both in loss of structures and environmental damage. Residents living in high risk areas as well as those who vst and vacation in such areas need to be better informed how to prevent wildfires from occurring as well as protect themselves , their families, and property should wildfire occur in their area.

What has been done

MSU Extension Firewise program staff offer educational presentatios and displays with a variety of free handout materials to assist residents in learning what they can do to prevent wildfire as well as lessen the vulnerability of their property to wildfire should one occur. During 2013, materials were developed by educators to address steps that can by taken by local zoning officials to offer additional protection beyond what an individual resident can do.

Results

An evaluation of Firewise found:

· 97% reported that the presentation increased their awareness of how to be firewise.
· 100% reported that the presentation raised their awareness of how to prevent wild fire damage to property.
· 54% were very likely and 43% were somewhat likely to change something on their personal property from the information provided during today's presentation.

For example:

o **78% will try a HOME IGNITION ZONE** (such as 30 feet of space immediately around

home; thinning or removing dead leaves/needles)
o **56% will try LEAN, CLEAN, AND GREEN LANDSCAPING** (Pruning trees so lowest branches are 6-10 feet high)
o **52% will put in a FIRE-RESISTANT ROOF CONSTRUCTION** (proper materials like Class-A asphalt shingles, metal, slate or clay tile, concrete products)
o **82% will assess FIRE-RESISTANT ATTACHMENTS** (assessing decks, porches, or fences)
o **48% will seek FIRE-RESISTANT CONSTRUCTION** (Wall materials that resist heat and flames)
o **52% will make A DISASTER PLAN**
o **59% will consider EMERGENCY ACCESS** (residence has clearly marked street names and numbers, proper driveway dimensions)

4-H Life of Lake Superior - Wind Energy Workshop for 4-H youth

Issue (who cares and why)?

There is a need to build science literacy on a local and state level.

What has been done

One example, MSUE develdoped and implemented the Life of Lake Superior Workshop for 4-H youth, an engineering workshop featuring Topic/s: Alternative Energy: Wind Energy Challenge**.** This engineering and design problem was designed to be solved with a variety of devices. In this activity youth designed and built a turbine that used wind power to life a load. Constraints: To qualify as a wind turbine, the device had to include blades that turn a shaft. Youth were asked to use a pulley or string that winds around the shaft to lift a container that holds pennies. Key Take-Home Messages:

- The engineering design process is a framework/process that engineers use to solve problems or challenges.
- The engineering design process includes "going back to the drawing board". Meaning that the engineer/design process always contains "do-overs" (called iterations), where engineers learn something valuable from something that went wrong; and they go back to fix it.
- Making mistakes is an accepted part of the engineering design process.

Results

- One hundred percent of adult and teen/youth leaders indicated that the children involved in the wind energy session at Life of Lake Superior learned something new.
- One hundred percent of adult and teen/youth leaders indicated that the children involved in the wind energy session at Life of Lake Superior appeared to gain interest in science because of today's activities.
- Eighty-seven percent of adult and teen/youth leaders indicated that because the children involved in the wind energy session at Life of Lake Superior were interested in the science activities today, they will look for more opportunities for them to be in 4-H science projects or clubs.

- One hundred percent of adult and teen/youth leaders indicated that, after being involved in the wind energy session at Life of Lake Superior, they have a greater understanding of science resources and learning opportunities provided by MSUE 4-H.
- Eighty-seven percent of adult and teen/youth leaders indicated that, after being involved in the wind energy session at Life of Lake Superior, they plan to use 4-H as a future resource for science education.

Ties to the Land

Issue (who cares and why)?

Michigan boasts more than 20 million acres of forestland with more than 40 percent owned by 440,000 families and individuals. These forests are sizable natural and financial assets when considering the value of the land, timber and other features. Challenges exist, however, including:

» 39 percent of forest owners are 69 years old or older.

» 44 percent said that their heirs are too dispersed.

» 38 percent indicated that one or more heirs are disinterested.

» 35 percent have difficulty finding qualified advisors.

What has been done

The MSU Extension Ties to the Land program helped families negotiate the financial and legal issues of planning a transfer of these forestlands from one generation to the next.

Results

Participants in a follow-up survey representing 11,828 forest acres, included the following results:

» 72 percent discussed goals for their property within the last year; an additional 22 percent intend to do so within the next six to 12 months.

» 44 percent have taken steps to increase family involvement in property; 17 percent intend to do so within the next six to 12 months.

» 39 percent explored legal structure for estate planning; 28 percent intend to do so within the next six to 12 months.

Keeping it Green: Recycling Waste to Resources

Issue (who cares and why)?

Waste materials can be a major issue to dispose of. Recently more work in recycling and re-using the materials has both environmental benefits but economical.

What has been done

MSU and MSU Extension hosted "Keeping it Green: Recycling Waste to Resources" in August 2013 to highlight sustainable campus-based projects focused on reducing and reusing organic waste and converting it into energy. During the event, the South Campus Anaerobic Digester system was unveiled showcasing how the project impacts campus energy and sustainability by taking organic waste and turning it into power. The organic matter used to feed the system includes campus waste, such as food waste from dining halls and cow manure from the MSU Dairy Teaching and Research Center, as well as grease from local restaurants and fruit and vegetable waste from the Meijer Distribution Center in Lansing.

Results

The South Campus Anaerobic Digester system:

» Will use 17,000 tons of waste from university farms and dining halls.

» Will generate 2.8 million kilowatt hours of electricity per year to power several buildings on South Campus.

» Is the largest anaerobic digester on a college campus in the United States.

» Diverts 10,000 tons per year of landfill and wastewater.

Key Items of Evaluation

AgBioResearch scientists are developing a reliable, cost-efficient method to monitor bear population dynamics and help the MDNR assess hunting license quotas, a key component of black bear management. Current population estimation techniques are time-consuming and costly. Researchers are using statistical catch-at-age (CAA) models to estimate [fish] mortality rates and the rates of recruitment or entry of
new, young individuals into a population, and to determine what fraction of death is due to harvesting. The models can then be used as a basis for rational management. We are also hopeful that the CAA model
will produce detailed estimates of how mortality varies among ages with the amount of hunting effort between bear sexes, allowing for better projections of what the bear population would do in the future, given different management actions

The sea lamprey is one of the oldest and most ecologically dangerous invasive species in the Great Lakes. Discovered in Lake Ontario in 1835, it has since spread through all five lakes in the world's largest freshwater system. A parasite, the sea lamprey latches onto fish with a concentric array of razor-sharp
teeth and feeds on bodily fluids until the host dies. With no natural predators in the Great Lakes, sea lamprey have contributed to the unbalancing of the lake ecosystems, playing a significant role in the devastation of lake trout in Lake Superior and drastic population reductions in many important native predator and game fish. Recent landmark findings by Michigan State University (MSU) AgBioResearch scientist's laboratory have yielded hope for both new sea lamprey management techniques and insights into vertebrate evolution. In a paper published in 2013, a team of more than 60 researchers from 10 laboratories across the United States and Europe described the entire genome of the sea lamprey. This project, initiated by the National Institutes of Health, provides an unprecedented understanding of the species. Because of the profound impact that the sea lamprey has on our ecosystems, understanding its genome will be beneficial to both the Great Lakes ecosystem and the field of biology as a whole.

Evaluation Results from MSU Extension Greening Institute Work Teams include:

Indicator
Reported
Number of adult and youth participants who access MNFI, DNR and DEQ data.
115
Number of adult and youth participants who indicate they know how to access needed information.
121
Number of adult and youth participants who implement a practice to mitigate an ecosystem threat.
1,550
Number of participants who initiate or contribute to ecosystem-related planning in their local area.
18
Number of adult and youth participants who indicate their awareness of human impacts, such as exotic invasive species, habitat damage or non-point source pollution.
53
Fostering: Number of local ordinances amended to accommodate economic development, placemaking, form based coding, Firewise provisions, and other similar measures
16
Number of youth program participants who increase involvement in community issues.
12
Number of community leaders with increased awareness and skills in global or new economy (such as but not limited to placemaking, entrepreneur-friendly, regionalism, and so on).
25
Fostering: Number of community leaders with increased awareness and skills in measures to prevent damage from wild fire and local regulation to deal with wildfire issues.
62
Number of youth program participants who increase knowledge on tribal, state, and local

government.
12
Governance: Number of boards who have adopted new or improved rules or processes for compliance
13
Governance: Number of participants that report their board used new skills or techniques to improve the effectiveness of their meetings and/or processes at the local or regional level.
184
Governance: Number of boards who implement improved citizen engagement strategies.
53
Number of boards who report improved use of data and relevant information to inform their decision making
31
Number of participants who show understanding of relevant laws and the practical impacts of those laws on their boards
233
Number of participants who increase knowledge of their board's structure, functions and duties, and/or operational best practices
394
Number of participants who increase their knowledge of citizen input processes and /or methods to implement those practices
47
Number of participants who can identify and locate resources for quality information and/or apply that information to the solution of problems
151

Enhance Michigan's First Green Industry: Agriculture and Agribusiness Institute

Indicator
Reported
Change in nutrient use, lbs*
103,684
Change in pesticide use, lbs*
2254
Change in sediment retained, tons
2000
Number that change away from broad spectrum products
80
New acres under irrigation management
1,962
Amount of fossil energy displaced by bioenergy, BTU's
2,890,011

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Plant Sciences

☑ Reporting on this Program

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	0%		17%	
202	Plant Genetic Resources	0%		9%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		5%	
204	Plant Product Quality and Utility (Preharvest)	10%		5%	
205	Plant Management Systems	30%		10%	
206	Basic Plant Biology	5%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	10%		13%	
212	Pathogens and Nematodes Affecting Plants	10%		11%	
215	Biological Control of Pests Affecting Plants	0%		5%	
216	Integrated Pest Management Systems	30%		15%	
806	Youth Development	5%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	20.4	0.0	14.0	0.0
Actual Paid Professional	33.6	0.0	22.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1560727	0	1884252	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1560727	0	1956747	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	8895962	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

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 actitivities 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. Brief description of the target 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.

3. How was eXtension used?

eXtension was a major part of our multi-state effort (along with work with the North Central Region). In this area, 29 educators responded to Ask an Expert on 1,003 issues. A example is:

Members were activiely involved the following Communities of Practice (CoP) for this area:

Agricultural & Food Law
All About Blueberries
Apples
Consumer Horticulture
Cooperatives
Corn and Soybean Production
eOrganic
Forest Farming
Grapes
Invasive Species
Plant Breeding and Genomics
Sustainable Ag Energy
Women in Ag Learning Network
Wood Energy
Youth Agriculture

An example in this area is:

Apple Crop Damage
Rather than trying to decipher the message myself I've chosen to post excerpts from an email from a local resident regarding apple and plum issues, compost questions, etc. Please advise! Thanks!

"I think we have coddling moths and apple maggots. My husband sprayed lime sulphur one or twice, but apparently, we need more input than just that. Can you give us some pointers to increase the quality of our crop?

I think I have coddling moths, because much of the fruit looked like this: and it got much worse in later fall as they had time to burrow around or it may be apple maggots

I think we also had some flyspeck and sooty blotch - those don't really bother me but I thought it might help I.D. our problems. I think we also have some tarnished plant bugs, but they don't make the whole apple

unusable. We've had long grass under the trees which I think we need to remove and perhaps mulch. Is there a preferred mulch for apples?

Also, our plums had a boom year but many rotted from the inside out. You could see many small points of mold emergiing from the skins. I thinned the fruit several times, but apparently not enough. What was wrong and What treatments do I need to do to minimize that molding agian.

I'm looking for a list of what to do when this next year. I'd like the treatments to be as organic as possible, but I think our pests have built up over time so I may need some extra help from chemicals until I can get those numbers down.

I also wonder how easy it is to kill the pests if you compost. I'm not sure I can get our compost hot enough in the winter to take care of the fallen fruit I've picked up."

Reply

The apple damage looks like apple maggot. http://www.apples.msu.edu/applemaggot.htm.Codling moth has more of a distinct tunnel in the fruit. http://www.apples.msu.edu/codlingmoth.htm I don't think it is likely that codling moth is a significant pest that far north late in the season, but apple maggot makes a lot of sense. MSU does not have a lot on home fruit on their new website and they are thinking of adding more in 2014. I have several home owner spray guides I can send if you want.Virginia Tech posts one each year.http://www.virginiafruit.ento.vt.edu/SprayGuide/HomeFruitSprays.htmlI was never able to figure out any organic way to control apple maggot since crabapples and hawthorn are also hosts for this pest. Organic growers hang lots of red balls covered with tangle foot and clean them off regularly.The plums sound like brown rot. The sulfur sprays before and during harvest would be an effective organic material to reduce rot. They would also want to remove all the mummies on their trees.http://www.cherries.msu.edu/ambrwnrot.htmLet me know if you need anything

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	5717	17151	9458	28374

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2013
Actual:	25

Patents listed
MICL01654 - Genetic improvement of beam (phaseolus vulgaris L.) for yield, pest resistance and food value - 201100450, 06/19/2013. MICL01533 - Genetic engineering of oilseed crops - 2006295375 (AUS, 09/27/2012. MICL01940 - Regulation of metabolism in developing seeds of arabidopsis - 61/709,447, 10/04/2012; 13/719,868 12/19/2012; 61/723,662, 11/07/2012; 61/779,710, 03/13/2013; 13/719,301, 12/19/2012; 8,362,319, 01/29/2013; 8,362,318, 01/29/2013. MICL02013 - Genetic improvements of soybean for food value, yield and pest resistance - 13/567,884, 08/06/2012; 61/734,068, 01/04/2013; 8,227,662, 07/24/2012; 8,237022, 08/07/2012. MICL02265 - Genetic and genomic based approaches for exploring biology and evolution in the solanaceae family - 13/787,029, 03/06/2013. MICL02133 - Molecular-genetic analysis of disease resistance signaling in the model system arabidopsis -pseudomonas - PCT/US212/047199, 07/18/2012. MICL02166 - Chemical catalysis and processing for advanced biofuels and biochemicals - 61/701,232, 09/14/2012; 61/717,804, 10/24/2012; PCT/US2013/29044, 03/05/2013; 8,293,935, 10/23/2012. MICL02172 - Genetic and genomic approaches for exploring fruit ripening, quality and diversity in solanaceae - 13/787,029, 03/06/2013. MICL02258 - Biology and management of insects in Michigan field crops - 61/734,038, 01/04/2013; 8,227,662, 07/24/2012; 8,237,022, 08/07/2012. MICL01733 - Baculovirus biotechnology - 8,383,402, 02/26/2013. MICL01886 - Mechanisms of fungal pathogenicity - 13/791,304, 03/08/2013.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	1	59	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research projects on plant sciences.

Year	Actual
2013	92

Output #2

Output Measure

- Number of adult participants trained in plant management systems.

Year	Actual
2013	5717

Output #3

Output Measure

- Number of youth participants trained in plant management systems.

Year	Actual
2013	9458

Output #4

Output Measure

- Number of adult participants trained in pathogens and nematodes affecting plants.

Year	Actual
2013	109

Output #5

Output Measure

- Number of adult participants trained in integrated pest management (IPM).

Year	Actual
2013	466

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of youth participants with increased knowledge of plant management systems.
2	Number of adult participants with increased knowledge of pathogens and nematodes affecting plants.
3	Number of adult participants with increased knowledge of integrated pest management (IPM).
4	Number of research programs to develop insect and disease control and/or cultural and management strategies for organic crops.
5	Number of research programs to develop biological controls for pest insects and diseases to minimize any effects on the environment.
6	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.
7	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.
8	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.
9	Number of research programs to develop improved varieties of economically important crops for Michigan and the region.
10	Number of adult participants with increased knowledge of plant management systems.
11	Number of research programs to develop weed control methodologies, protocols and practices.
12	Number of research programs to develop controls for pathogens and nematodes affecting plants.
13	Number of research programs to develop production protocols and environmental and cultural strategies for the floriculture/nursery industry.
14	Number of research programs to develop more effective post-harvest protocols and practices to minimize loss and enhance quality.

Outcome #1

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of adult participants with increased knowledge of pathogens and nematodes affecting plants.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	96

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Integrated pest management (IPM) offers agriculture a sustainable approach to deal with evolving pest challenges such as new invasive species, climate change, and pesticide resistance. Following a successful pilot IPM Academy in 2012, the team broaden the reach in 2013 to amplify the impact of the program by focusing on training sustainable agriculture educators and advisors from public and private sectors. The target audience included crop consultants, Michigan Department of Agriculture and Rural Development personnel, Natural Resource Conservation Service employees, chemical representatives, and early-adopters from Michigan and surrounding states.

What has been done
The Academy was a two-day professional development program covering fundamentals of pest management and identifying resources and technology for sustainable ag practitioners. An advisory group of farmers and representatives of the target audience helped develop the Academy content to ensure a relevant curriculum and well attended program. One hundred and nine participants attended the two days.

Results

Intended changes were collected during the two-day event with surveys. Follow-up evaluation is planned for the fall 2014.

Relationship to agriculture:

67% Grower/producer
7% Consultant/scout
7% Landscaper
6% Agricultural educator
2% (n=1) Student in agricultural sciences
2% (n=1) recreational gardener
9% (n=5) Other: technicians, arborist, researcher

Total number of acres represented by audience:

Vegetables 642 acres in Livingston, Clinton, Allegan, and Oceana Counties.
Christmas Trees 1,300 acres in Kalkaska and Montcalm Counties.
Field Crops & Forage 21,322 acres in Kent, Oceana, Allegan, Livingston, Montcalm, Muskegon, Ionia, Clinton Counties and Canada.
Fruit 491 acres in Leelanau, Grand Traverse, Oceana, Tuscola, Mason, Ottawa, Saginaw, Antrim, and Washtenaw Counties.
Hops 99.5 acres in Leelanau, Missaukee, Livingston, Kent, Ottawa, Calhoun, Ionia, Grand Traverse, Berrien, and Monroe Counties.

Number of acres committed to change: Acres plan to utilize, expand or improve use of the following IPM practices based on the IPM Academy.

24,292 Acres Access MSU IPM resources online
7,905 Acres Scouting for insects and diseases
6,077 Acres Scouting for beneficial insects
4,112 Acres Referencing weather modeling to make management decisions (e.g. Enviroweather)
7,654 Acres Only treating for pests when the economic threshold is reached, as applicable
1,777 Acres Supporting beneficial insect habitat to promote pest control via natural enemies
5,668 Acres Selection of pest resistant varieties or cultivars
18,367 Acres Alternative weed control strategies (e.g., cultivation)
4,209 Acres Alternative ground cover management (e.g., cover cropping)
313 Acres Sanitation practices (removal of inoculum, sterilizing implements etc.)
1,934 Acres Protecting native pollinators (mowing before spraying, spraying at night, etc.)
5,060 Acres Soil or tissue to make nutrient management decisions
6,437 Acres MSU information and management practices related to invasive pest management

What participants plan to utilize, expand or improve your use of any of the following IPM practices based on the IPM Academy:

77% (n=43) Access MSU IPM resources online
79% (n=44) Scouting for insects and diseases
71% (n=40) Scouting for beneficial insects
50% (n=28) Referencing weather modeling to make management decisions (e.g. Enviroweather)
54% (n=30) Only treating for pests when the economic threshold is reached, as applicable
54% (n=30) Supporting beneficial insect habitat to promote pest control via natural enemies

55% (n=31) Selection of pest resistant varieties or cultivars
45% (n=25) Alternative weed control strategies (e.g., cultivation)
52% (n=29) Alternative ground cover management (e.g., cover cropping)
34% (n=19) Sanitation practices (removal of inoculum, sterilizing implements etc.)
50% (n=28) Protecting native pollinators (mowing before spraying, spraying at night, etc.)
61% (n=34) Soil or tissue to make nutrient management decisions
68% (n=38) MSU information and management practices related to invasive pest management

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants

Outcome #3

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	419

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
One example in this area:

Juice grape growers operate on a very thin margin of profitability. It is important to reduce input costs where possible to improve profitability and still produce high quality grapes. Most of the juice grapes produced are sold through the National Grape Cooperative to Welch's. Last year, it was mandated that growers for National Grape assess their production practices via a tool called Grape-a-syst. Grape-a-syst is designed to help growers assess their level of sustainability and to identify possible environmental risks on their farm. The format also provides ideas for IPM and sustainable production strategies that are best suited to address these risks. Growers are expected to make progress toward adopting specific sustainability and IPM practices over time.

What has been done

Working with input from National Grape, the topics for a series of in-season grape IPM meetings held in 2013 included production issues that grape growers scored low on in Grape-a-syst. Topics included how to collect soil and petioles for testing, and how to interpret test results, weed management, identification of viruses, cost effective management of common fungal diseases and insect pests.

Results
Evaluation results found:

68% indicated that the information presented in the meetings saved them at least one pesticide application. The average rating of usefulness for the imformation presented was 8.6/10. Fifty percent (50%)of the respondents estimated that they saved an average of $641/ per acre from information learned at the meetings (on an estimated total of 1272 acres= $815,352).

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
American organic farmers represent only 1 percent of total U.S. farms, with 14,540 farms out of 2.2 million, and 4.1 million acres of land out of 922 million, with organic farms in all 50 states. Despite their smaller numbers, the sector grew by 8 percent in 2010, dramatically outpacing the food industry as a whole which grew at less than 1 percent in 2010. Overall, the industry has grown from $3.6 billion in 1997 to $29 billion in 2010, demonstrating that the organic sector will

continue to play a contributing role in revitalizing America's economy through diversity in agriculture. Given this, research to help these producers increase production and marketing efficiencies and control pests with methods that conform to organic standards is critical.

What has been done
Research to: optimize the production and use of thermophilic compost and vermicompost as important tools for organic and sustainable production and management of vegetable transplants and high tunnels for year round vegetable production and marketing on rural and urban farms; and to develop a methodology for quantifying multi-trophic crop/pest beneficial interactions.

Results
Culinary herb, leafy greens, tomato and pepper production and harvest continued in a 30'x72' high tunnel with certified organic production methods. Earthworm composting of food scraps continued in six production systems (window, beds, boxes, bags, plastic crates) housed in a 30'x72' high tunnel. The systems were maintained in two separate high tunnels and will be maintained and evaluated for winter temperatures, earthworm survival and production of earthworm compost. Vegetables were produced in containers of compost based root media maintained in a roof top garden. Ten 4' x 12' outdoor raised wooden beds (10" deep) were constructed and partitioned into 4'x4' sections that were filled with food waste thermophilic compost or vermicompost that will be evaluated for salad green production. The beds are protected with frost fabric covered metal frames for season extension. Charcoal was produced for incorporation into compost piles and vermicomposting systems. Ten combinations of tree leaves, grass clippings and added components such as dairy manure, wood shavings, peatmoss and office paper were hot composted so that the compost can be evaluated for use in compost water extracts for plant protection and for the production of vegetable transplants. A 30 by 32 foot greenhouse covered concrete composting pad was constructed for composting of campus food scraps.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	12

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Biological control is the use of living organisms to suppress pest populations, making them less damaging than they would be otherwise. Biological control can be used against all types of pests, such as vertebrates, plant pathogens, weeds and insects. Insects that were of little economic importance can become damaging pests. When a non-toxic control method is used, natural enemies are more likely to survive and reduce the numbers and damage of potential pest species.

What has been done
Research to: develop and deliver Integrated Pest Management strategies for insects in Michigan vegetable crops; develop stable, sustainable management strategies for vegetable insect pests; determine the effectiveness of currently registered and experimental products for control of insect pests in small fruit crops; improve control of moth pests by pheromone disruption; increase knowledge about mode of actions or effects of pests and diseases on honey bees to achieve better control and to gain increased honey production and more effective pollination of agricultural crops; to develop biological and cultural tactics based on vegetation management; to increase knowledge about the plant defense genetics; and to use new pest controls for tree fruit production.

Results
Researchers determined that Kentucky bluegrass lawns mowed at the highest setting on the mower, fertilized modestly, and watered during dry periods will rarely need an insecticide to prevent grub damage.

Researchers successfully expressed a sodium channel, AaNav1-1, from Aedes aegypti in Xenopus oocytes, which allowed us to functionally examine nine sodium channel mutations that are associated with pyrethroid resistance in various Ae. aegypti and Anopheles gambiae populations around the world.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

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. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Growers' livelihoods depend on production systems that are healthy and sustainable -- environmentally, ecologically and economically. Farmers in Michigan grow a diversity of crops second only to California, a state almost three times the size of Michigan. This world-class diversity necessitates a unique mixture of research and Extension programs to meet the needs of the state's growers, who produce more than 200 commercially grown commodities.

What has been done
Research to: identify and characterize phloem-associated lipids and lipid-binding proteins and identify their role in plant development and pathogen defense response; optimize protocols for honeycrisp storage in air and in controlled atmospheres; utilize and integrate physiological, genetic and horticultural approaches for understanding and improving Great Lakes region high value fruit production; decrease reliance on conventional crop protection practices by using low environmental impact fungicides in combination with host resistance; and to improve row crop nitrogen management to optimize economic returns and reduce environmental impacts.

Results
The MSU dry bean breeding and genetics program conducted 25 yield trials in ten market classes and participated in the growing and evaluation of the Cooperative Dry Bean, Midwest Regional Performance, and the National Sclerotinia Nurseries in Michigan and winter nursery in Puerto Rico in 2013. White mold infection developed well in 2013 and genotypic differences were

observed. A total of 3,960 plots were harvested for yield in 2013 and approximately 2000 single plant selections were made in the early generation nurseries.
Researchers have continued to develop projects that evaluate the response of beneficial insects to habitat manipulation, with important findings of increased blueberry yield adjacent to these wildflower plantings. On-farm demonstrations of programs have provided venues for growers and extension educators to see the quality of the fruit first hand, and this has a large impact on grower perception of program performance. Growers have reported excellent fruit quality where our IPM programs have been adopted appropriately. Growers are now very aware of Spotted Wing Drosophila and are using our information to guide their management of this damaging new pest.

4. Associated Knowledge Areas

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

Outcome #7

1. Outcome Measures

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. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	24

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As the world population increases and the demand for food and fuel relies more heavily on agricultural products, efficient methods of plant transformation will be required. Although conventional breeding will fulfill a part of this need, these techniques are limited to the gene pool of the species involved. In contrast, the tools of genetic engineering significantly expand the resources that can be used for variety improvement. Further, current transformation techniques are not applicable to all plant species.

What has been done
Research to: identify molecular markers for traits that are important in highbush blueberries; identify high-yielding oat, barley and canola cultivars for Michigan; provide guidance on disease control and crop health to the Christmas tree and chestnut industries; determine the biochemical mechanisms involved in turfgrass disease control; develop production methods to increase net returns to Michigan berry producers; elucidate molecular and biochemical mechanisms of plant resistance to arthropod herbivores; determination of how to better control for fungal and bacterial diseases of plants; and to develop improved analytical methods for the profiling of metabolites to assist in comprehensive measurements of biomarkers related to plant and animal health.

Results
Two oat variety trials were conducted in East Lansing. These trials tested varieties and promising lines from the MSU program and varieties from programs in the USA and Canada.

Two new highbush blueberry cultivars were released, Calypso and Osorno.

Nineteen advanced soybean breeding lines were entered in regional trials (The Uniform Soybean Tests, SCN tests, and Quality Trait Tests) and in Michigan soybean variety trials. Two vegetable soybean varieties and one non-GMO soybean variety were released. One was licensed to a seed company.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
206	Basic Plant Biology

Outcome #8

1. Outcome Measures

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. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual

2013 6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research on plant resistance to environmental stress is essential to sustainable agriculture. Determining how to develop or enhance resistance is a critical research area. Before plant varieties that are insect- or disease-resistant can be developed, scientists have to find a source of plant resistance and then determine how to cross-breed plants or isolate the responsible genes and then move them from one plant to another.

What has been done
Research to: better understand disease resistance signaling in plants; determine foliage thresholds based on the assimilation and storage of carbon; improve the efficiency of crop production through increased understanding of the genetics controlling plant growth and development; determine the effects of stress on plant metabolism; and to understand the genetic mechanism by which plants tolerate environmental stresses.

Results
Researches are working to improve yield of Stevia rebaudiana ? A genetic mapping population comprising ca. 200 individuals was developed and phenotyped for steviol glycoside synthesis and agronomic traits at three locations throughout Michigan. We developed a reference transcriptome from RNA seq data for one of the parents of the mapping population.

Researchers have been able to express various protein constructs, in planta and in vivo, for structure-function analysis. Additionally, a number of genetic lines have been made to assist in molecular-genetic analysis of disease resistance.

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	21

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agriculture is Michigan's No. 2 industry. The state's agrifood system accounts for $71.3 billion in total economic activity and 600,000 jobs. Michigan is also one of the most diverse agricultural industries in the United States, growing more than 200 commodities. As the world population increases and demand for food and fuel relies more heavily on agricultural products, efficient methods of plant transformation will be required. Developing improved crop varieties is critical to sustaining an economically viable agriculture industry.

What has been done
Research to: identify the genes critical for the replication and repair of chloroplast DNA; understand the patterns of evolution of flora forms that contributes to the reproduction and persistence of Michigan plants; increase the environmental and economic sustainability of small fruit production through management of diseases in Michigan; understand the central plant metabolism and transport in plant systems well enough to rationally manage and engineer them for human benefit; develop a data-driven protocol for culture of juice grape cultivars as well as fruit plant canopies and management systems that fit into these advances to achieve maximum efficiency; and to discover genes that are co-expressed with genes known for amino acid biosynthetic and catabolic enzymes.

Results
Researchers relocated a number of rare flora species and identified several potentially invasive species in the survey area. Efforts are continuing to build a smartphone app to help identify Great Lakes Wildflowers. Efforts at adding to the database of the Michigan Flora increase 17-fold over last year, and these data are all available to the public.

In corn, trapping network showed that western bean cutworm catch decreased for a second year in Michigan, to very low levels, although populations near dry beans remain slightly higher than populations near corn. As a result of the trapping data, rather than a blanket spray recommendation as in previous seasons, in 2013 dry bean growers were told not to spray, unless they were in the upper peninsula of Michigan. This potentially saved growers the cost and time of an August insecticide application.

Researchers continued analysis of patterns of plant species composition and production across in response to different (existing) management practices and conducted a field experiment to further examine how harvest time and frequency impacted biomass production and species composition in mixed species grasslands.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	8039

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
One example, insects and diseases cause significant damage to Christmas tree foliage, decreasing saleability of the trees.

What has been done
Through IPM, MSU Extension educators taught Christmas tree producers how to reduce inputs of pesticides and improve timing of necessary sprays. MSU Extension helped growers form management plans to controlmany types of insects and disease such as the Douglas-fir needle midge, hemlock scale, pine needle scale and pine tortoise scale. Educators also helped growers scout their fields to determine when insects were active, look at spray coverage and evaluate the effectiveness of their spray programs.

Results
Evaluation results found:

Michigan Christmas tree growers working with MSU Extension's Integrated Pest Management (IPM) reported they were able to harvest trees that would have been unsaleable due to pest damage resulting in a $1,021,200 gain to their businesses.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #11

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Weed control is an essential part of all crop production systems. Weeds reduce yields by competing with crops for water, nutrients and sunlight. Weeds may also reduce profits by hindering harvest operations, lowering crop quality and producing chemicals harmful to crop plants. Weeds left uncontrolled may harbor insects and diseases and produce seed or rootstocks that infest fields and affect future crops. Weeds are a major source of yield loss for growers in Michigan and in the North Central Region. It is estimated that losses due to weeds left uncontrolled exceed $7.5 billion in the United States.

What has been done
Research to: help define management strategies that address shifts in weed populations; understand the degree to which weeds affect crop establishment and production in traditional and emerging cropping systems; identify effective practices for weed control in annual and perennial horticultural crops; determine the mode of action and basis for selectivity and fate of new or potentially new herbicides for weed control in Michigan; and identify the fundamental factors in cultural and chemical weed control, weed composition and weed life cycles.

Results
Several new herbicide uses were labeled in 2013. Indaziflam is now labeled for pome fruit, stone fruit and grapes. Flazasulfuron is labeled on grapes. A new formulation of napropamide is labeled on several fruit and vegetable crops. The isoxaben label was expanded to include bearing grapes and newly established grapes. The pendimethalin label was expanded to include preemergence application on green onions. The clopyralid label was expanded to include apple. Prostrate pigweed was confirmed to be resistant to terbacil in native spearment fields. The halosulfuron label was changed to reduce the preharvest interval to 21 days, which allowed for use of halosulfuron postemergence on machine harvested pickling cucumbers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #12

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nematodes are among the parasites that attack numerous economically important plants, substantially reducing their yield potential by destroying their root system. Pathogen epidemics are a constant problem for agriculture and are known to influence natural ecosystems, especially when alien pathogens successfully invade new areas.

What has been done
Research to: examine methods and problems associated with controlling disease in agriculture; gain a strategic understanding of the complexity of nematode problems and necessary disciplinary interactions; develop new, safer methods of insect control by using baculovirus

biotechnology to either improve the insecticidal properties of baculoviruses or as a tool for designing safer chemical insecticides; to develop, assess and deliver effective IPM programs in cherry, apple, peach and some row crop conventional and organic commodities in the Upper Midwest; and to employ ecological and evolutionary perspectives to understand the dynamics of plant disease

Results
Researchers began using hypovirus to treat chestnut blight in two commercial orchards with the aim of evaluating hypovirus effectiveness at controlling blight while maintaining nut production. These experiments are an extension of work carried out on the Michigan State University Campus over the past three year, which have found that
hypovirus can maintain tree health while keeping nut production at about 85% of uninfected control trees. In contrast, untreated 20% of untreated trees have died and nut production of the remaining infected trees is approximately 40% of uninfected trees.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

Outcome #13

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The wholesale value of floriculture crops produced in Michigan is more than $400 million annually. Michigan's 625 commercial floriculture companies showed an estimated value of $402.7 million, with over half of them reporting wholesale sales of more than $100,000. Total greenhouse cover is about 50 million square feet, with an additional 3,600+ acres of open ground for floriculture production. Research in this area is critical to keeping this industry viable and profitable.

What has been done

Research to: improve control over quality loss in horticultural produce; evaluate turfgrass species and mixes for their adaptation to athletic field turf and to assess the effects of cultural practices;improve the environmental sustainability of the Michigan landscape tree industry by optimizing water and nutrient inputs and determining the utility and potential impacts of organic fertilizers;
investigate nitrogen fate in turfgrass; evaluate several perennial semi-aquatic or aquatic plants for use in the phytoremediation of nursery runoff water; and to develop protocols that growers and retailers can use to produce and profitably sell perennials as new floriculture crops while

Results

Studies to evaluate fairway rolling to control turfgrass diseases and reduce pesticide inputs were continued. Additionally, Agrostis palustris, creeping bentgrass, seeding rate studies were initiate in 2012, and continued in 2013. Early results suggest lower seeding rates are equal to higher rates. The objective is to identify the proper seeding rate range to ensure a successful establishment, capable of withstanding play the first year of establishment, during a renovation of the golf course.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #14

1. Outcome Measures

Number of research programs to develop more effective post-harvest protocols and practices to minimize loss and enhance quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers and food sellers have been concerned about losses since agriculture began. Yet the problem of how much food is lost after harvest to processing, spoilage, insects and rodents or to other factors takes on greater importance as world food demand grows. Cutting postharvest losses could add a sizable quantity to the global food supply and reduce the need to intensify production in the future. Estimates of total postharvest food loss are controversial and range widely, generally from about 10 percent to as high as 40 percent.

What has been done
Research to: Improve orchard and vineyard postharvest technologies and postharvest recovery of sugars and pectic polysaccharides from plants.

Results
Apple and sweet cherry trees planted in high density systems were established in 2010 and used to study the feasibility of
using a micro-irrigation overhead system to apply chemicals such as pesticides, growth regulators and chemical dyes (solid set canopy delivery systems). The initial testing of the SOLID SET CANOPY DELIVERY SYSTEM project on high density apples and sweet cherries resulted in optimum delivery rates in operation of the system comparable to traditional sprayer system for apples with concerns for design adjustments for sweet cherry.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

V(H). Planned Program (External Factors)

External factors which affected 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.)

Brief Explanation

The ongoing economic challenges being faced by Michigan -- including the recent federal funding sequestration process -- 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. Although overall research FTEs only decreased by one -- from 65 FTEs to 64 FTEs this past year, we are down from 77.1 FTEs just two years ago.
Specifically, a 15 percent decreases in state funding FY2011-2012 coupled with a flat federal funding line for two consecutive 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 AgBioResearch 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.

These reductions caused some stakeholders to question the commitment of Extension and AgBioResearch to Michigan agriculture. In an effort to address these concerns, leaders from both organizations participated in a series of 13 open forum meetings held throughout Michigan in 2013. Stakeholders and community members asked questions and had the opportunity to learn more about the past decisions and future plans of Extension, AgBioResearch and the MSU College of Agriculture and Natural Resources. It was a valuable exchange between the organizations' leaders and industry stakeholders across Michigan, and helped to ease some tension caused by the cutbacks.

Together, Extension and AgBioResearch continue to serve as the primary research and development arm for the agriculture and food industries in Michigan, valued at more than $91 billion annually.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

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 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.

See MSU Extension Institute Workgroup Team Impacts below.

Key Items of Evaluation

The search for sustainable sources of clean biofuels has led researchers to examine a wide array of organisms from across the entire biological spectrum. Corn, soybeans, a range of grasses and trees grown solely as energy crops, and even animal fat have all been studied. Recently, this search has taken
scientists into the depths of the ocean, where oil-producing algae have offered new possibilities. Algae have become an attractive fuel source because they produce little in the way of greenhouse gases, require less land than other biofuel crops and do not compete with food production, which has been a challenge
to using crops such as corn. In 2008, the U.S. Department of Energy estimated that replacing all petroleum fuel in the country with algae-based fuel would require only 15,000 square miles, or approximately
0.42 percent of the land area of the United States. One alga genus that holds promise is Nannochloropsis. Various species of Nannochloropsis are currently used as energy-rich food sources for fish larvae.
Their ability to generate high quantities of lipids (naturally occurring fats), and other molecules used for energy storage, coupled with rapid growth rate, make them ideal biofuel candidates. One particular species,
Nannochloropsis oceanica (N. oceanica), is being studied as an example of algae's biofuel potential. The benefits of unlocking N. oceanica are far-reaching and varied -- it offers advancements not only for algal biofuels but also for agricultural biofuels and medicine.

A 2008 survey from the U.S. Department of Agriculture National Agricultural Statistics Service found that 89
percent of the 63.6 million acres of soybean fields in the United States had been exposed to the soybean aphid, a devastating insect pest. Originally from eastern Asia, the soybean aphid sucks sap from the soybean plant and secretes sticky sugars that promote black mold growth, which inhibits photosynthesis.
Female soybean aphids are born already pregnant, producing new generations in as few as five days. Up to 15 generations of aphids can be found on a single untreated plant. Soybean aphids can reduce the crop
yield by up to 50 percent and also spread viral diseases. An MSU associate professor of crop and soil sciences, has been developing an alternative means of defeating the soybean aphid. Rather than depending
on toxins that also threaten beneficial insects present in soybean fields, Researchers have been working since 2002 to breed soybeans resistant to the aphid. They used seven sources of resistance and evaluated more than 1,000 breeding lines for aphid resistance each year. Work continues to narrow down the genes and gene markers that make a plant aphid-resistant.

Rebounding from one of the worst growing seasons in more than 50 years, Michigan apple producers were expected to harvest a record-setting 30 million bushels in 2013. It's an estimated yield nearly 10 times greater than the 2.7-million bushel harvest of 2012.Though the bumper crop was a relief to growers and a boost to the state's economy, storing the crop in a manner that does not compromise the apples' firmness, flavor or aroma requires a great deal of science. That research helps to ensure quality fruit year
round and prevents the market from being flooded. Michigan State University (MSU) AgBioResearch horticulturist has discovered a genetic pathway that plays an important role in producing apple aroma profiles, a key quality that helps Michigan apples remain competitive in national and international markets. Further exploration of this gene-along with a series of experiments that involved dissecting bacterial pathways, studying stabel isotopes, isolating genomic DNA, expressing the gene in a bacterial system and

determining the function fo certain proteins--led to the identification of a previously undiscovered plant pathway; the ctramalate pathway, which contributes to the formation of branched-chain acids and branched-chain esters.

Enhance Michigan's First Green Industry: Agriculture and Agribusiness Institute

Indicator	Reported
# of acres adopting practices to increase yield, improve quality, or decrease inputs	644,783
# of farms adopting practices to increase yield, improve quality, or decrease inputs	896
$ changed due to yield/productivity change	$3,082,888
$ changed due to change in input costs	$1,059,855
# of farms adopting practices that manage risks	1,119
# of acres adopting practices that manage risks	157,731
# of acres adopting technology or tools to manage risks	10,778
$ value of product protected	$34,418,951
$ value of product gained	$1,820,166
$ value of product saved	$31,046,366
$ value reduced variability (due to yield, quality, income)	$1,273,470
Number that change away from broad spectrum products	80

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Economics, Marketing and Policy

☑ Reporting on this Program

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	35%		20%	
602	Business Management, Finance, and Taxation	20%		6%	
603	Market Economics	20%		8%	
604	Marketing and Distribution Practices	5%		5%	
605	Natural Resource and Environmental Economics	0%		14%	
606	International Trade and Development	0%		11%	
608	Community Resource Planning and Development	15%		10%	
609	Economic Theory and Methods	0%		12%	
610	Domestic Policy Analysis	5%		9%	
611	Foreign Policy and Programs	0%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	25.8	0.0	4.0	0.0
Actual Paid Professional	30.3	0.0	9.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1376788	0	742274	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1376788	0	770840	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	3504470	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

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. Brief description of the target 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.

3. How was eXtension used?

eXtension was a major part of our multi-state effort (along with work with the North Central Region). In this area, 19 educators responded to Ask an Expert on 501 issues.

Members were activiely involved the following Communities of Practice (CoP) for this area:

Brand Value
Community, Local and Regional Food Systems
Enhancing Rural Capacity
Entrepreneurs and Their Communities
Land Use Planning
Map@Syst
Network Literacy
Tourism and Recreation

An example in this area is:

In general, what are the zoning requirements for growing hops and having a...
In general, what are the zoning requirements for growing hops and having a home occupation for making and selling beer to local bars. Is Health Department approval needed, and is a liquor license necessary. Only kegs will be sold to establishments in the area that already have a license.
Reply
Hi there

Zoning really depends on your township. So I would start there. I would contact MLCC right off the bat to see what you need in terms of permits.

http://www.michigan.gov/lara/0,4601,7-154-35299_10570---,00.html

Licensing FAQs Licensing Telephone 1-866-813-0011

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6254	18762	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2013
Actual:	25

Patents listed

MILC02249 - Microbial processes for bioproducts and biofuels production - PCT/US2012/053958, 9/6/2012; MICL02276 - Designing Sustainable Bioenergy Systems - 13/591,092, 8/21/2012; PCT/US2012/059898, 10/12/2012; 13/342,052, 12/17/2012; PCT/US2013/208689, 3/1/2013; 13/835,382, 3/15/13; 13/886,021, 5/2/2013; 13/835,766, 3/15/2013; PCT/US2013/038452, 4/26/2013; 61/817,204, 4/29/2013; 12/226,763, 8,394,611, 3/12/2013. MICL02184 - Regional Biomass processing centers for sustainable biofuels and animal feeds - 13/591,092, 8/21/2012; PCT/US2012/059898, 10/12/2012; 13/642,052, 12/17/2012; PCT/US2013/028689; 13/835,382, 3/15/2013; 13/886,021, 5/2/2013; 13/835,766, 3/15/2013; PCT/US2013/038452, 4/26/2013; 61/817,204, 4/29/2013; 12/226,763, 8,394,611, 3/12/2013. MICL02190 - The pyrolysis of lignocellulosic biomass to fuels and chemicals: Mechanisms, upgrading and economics - 61/717,804, 10/24/2012; PCT/US2013/29044, 3/5/2013; 61/798,598, 3/15/2013.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	2	17	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research programs on economics, marketing and policy.

Year	Actual
2013	37

Output #2

Output Measure

- Number of adult participants trained in economics of agricultural production and farm management.

Year	Actual
2013	1119

Output #3

Output Measure

- Number of adult participants trained in business management, finance and taxation.

Year	Actual
2013	3166

Output #4

Output Measure

- Number of adult participants trained in natural resource and environmental economics.
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Number of adult participants trained in community resource planning and development.

Year	Actual
2013	1969

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 natural resource and environmental economics.
4	Number of adult participants with increased knowledge in community resource planning and development.
5	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.
6	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.
7	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.
8	Number of research programs to develop a framework to understand and analyze domestic and international trade policies and assess their impact on Michigan.
9	Number of research programs to develop models to estimate the demand for and value of recreational fisheries and wildlife resources.

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1007

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many people look to the growing Michigan wine and grape industry to expand or create businesses.

What has been done
A winery development program was offered February 13, 2013 as a pre-conference of the Michigan Grape & Wine Conference sponsored by the Michigan Grape & Wine Industry Council, Michigan Department of Agriculture & Rural Development, and Michigan State University. The location was the Kellogg Center at Michigan State University.

Educational topics included grape-growing regions, industry status, business planning, marketing, grape procurement, licensing requirements, the three-tier system, local zoning, and lender financing. Supplemental sessions involved available educational resources, and development resources. A panel of existing winery owners shared their experiences and made recommendations to prospects. The featured speaker was Miguel Gomez of Cornell University who focused on costs of starting a winery.

Results
Results of 10-month followup survey:

One hundred per cent (100%) indicated that the conference met their educational needs. Ninety-two per cent (92%) would recommend the conference to others.

Responses (?agree? and ?strongly agree?) as to how presentations helped toward with steps taken since the conference are, as follows:

Have taken advantage of available educational resources-92%

How to target a customer helped me understand how to successfully market wines-92%

Impacted decision to start a winery-86%

Business planning session has shaped my winery plan-82%

Licensing as a part of the process of starting a winery-79%

Grape-growing regions helped to understand which types of grapes to grow-64%

Grower-relationships topics helped on decision to source grapes-50%

Have used information about lending for financing-35%

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	2849

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Michigan Cottage Food Law enabling the production of certain foods in a home kitchen for direct sales is still relatively new. Educational programming with potential business owners is in

demand.

What has been done
Members of the MSU Extension and Product Center staff collaborated with HNI Food Safety Team members to plan, conduct and evaluate Starting a Successful Cottage Food Business in Michigan.

Results
Evaluation results found:

100% reported as a result of this session, they better understood what is necessary to run a successful cottage food business.
86% reported being able to legally produce and sell my favorite food item under the cottage food law as a result of the program.
30% planned to start a new cottage food business in 2013 and 48% said they might start a business.
60% of program participants reported that the session met their needs and another
32% reported that the program more than met their educational needs.

Follow-up evaluation found:

Participants shared program information with 1,336 other people.
12% started a new cottage food business in 2013.
30% of program participants plan to start a cottage food business next year.
22% of respondents indicated that they will start a licensed food business.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

Outcome #3

1. Outcome Measures

Number of adult participants with increased knowledge in natural resource and environmental economics.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

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. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	17

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Public policy has taken on considerable importance to the future of agriculture. The farmer's historic struggle was with the forces of nature and the marketplace, and government policy played a minor role. Government policy at all levels now is a major player in agriculture, especially related to agriculture as an important economic asset - the sustainability of a productive agricultural sector balanced with the preservation of environmental quality and the importance of prime farmland with respect to the continued viability of the rural economy and of rural lifestyles.

What has been done
Research to: develop a dynamic model to analyze the long-run impacts of renewable energy development on fossil fuel supply; provide a more comprehensive understanding of tourist preferences for tourism management and development; provide information that can contribute to better design and better use incentive-based conservation; develop rural Latino communities in Michigan; develop environmentally benign bioprocesses to effectively utilize various renewable resources; visually characterize changes in food and agricultural systems examine the implications of sustainability principles for U.S. agriculture; elucidate the role of economics and law on environmental management; develop, extend and apply economic and ecological theory to analyze economic and ecological trade-offs associated with ecological problems; and to better understand impacts of climate change on crops; and sustainable bioenergy systems.

Results
The most economically efficient way to promote conservation can be found by thinking of predators as unregulated hunters that overharvest prey. For example, changing land use to benefit caribou can encourage preditors to reside elsewhere and efficiently improve conservation.

Development and empirical cerification of an economic principle-agent model of third party certification in the food industry to address emerging policy issues in the food system. Development and verification of public choice model of publica debt accumulation addresses an emerging issue related to future economic development for rural economies.

Positive impact on decision making concerning water resources, land use and ecosystem management, which will help resource beneficiaries and managers in the US and abroad improve the use, conservation and quality of water and water-related resources.

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

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. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	11

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research that enhances knowledge and informs risk analysis and management strategies and tactics related to the causes and effects of price, yield, and revenue risk in production agriculture and the costs of alternative strategies is critical to the long-term sustainability of the agrifood industry.

What has been done

Research to: explore, analyze and evaluate the dynamics and economic impact of entrepreneurial activity within the context of MI and global agrifood systems; further the understanding of coupled human and natural systems and sustainability; more broadly develop conceptual and analytically frameworks for understanding, assessing and empirically studying effective innovation in the agriculture, food and natural resource sectors; examine the causes and consequences of Michigan state and local government fiscal challenges; to discern the relationship between entrepreneurship and the Michigan agrifood sector; to develop sustainable energy and business systems; understand agricultural production economics in an environmentally conscious manner; and to improve the quality of natural resource management.

Results

New methods for analyzing trade and storage efficiency have been developed for private sector maize markets in Malawi. Results on the growing effective of private sector markets in meeting inter-regional trade and storage goals have been provided. Analysis has also been conducted on the effects of Zambian Food Reserve Agency maize buying on the levels and stability of private sector maize market prices. This is an important policy issue for Zambia government.

Integrating biofuel and animal feed production to grow cover crops allows us to use land more effectively to produce both food and fuel. Regional biomass processing depots feeding both animals and a cellulosic biofuel industry is being commercialized. The US DOE is constructing a pilot plant. Future research will be conducted on sustainable bioenergy systems.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices

Outcome #7

1. Outcome Measures

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. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2013 2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Management of personnel and human resources has changed over the past three decades, partially due to increasing employment legislation, education issues, employee awareness and changes in demographics. As competitors strive to win the war for talent, effective human resource management is necessary to gain true competitive advantage in the marketplace.

What has been done
Research to: study issues related to the management of human resources and "green" business practices in commercial recreation and tourism; profile and characterize consumers and markets for eco-friendly products.

Results
Researchers provided producers, distributors, and retailers with marketing information and customer preference with regard to ornamental plants and related products that have components of ecologically-sound, sustainable, local and/or organic production methods or systems. They also investigated preference for plant production systems, containers, and products.

4. Associated Knowledge Areas

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

Outcome #8

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The ability to understand the economic, cultural and political factors of domestic and international trade policies in order to determine the likely changes in these policies and their consequent market is essential to a competitive, sustainable Michigan economy. Research in this arena will provide information and resources that are critical to Michigan businesses, either directly or indirectly, as the balance of power within the marketplace shifts. As globalization of food industries continues, an assessment of such power requires analysis of world trends and the institutional structures that govern national and international actions.

What has been done
Research to: provide economic analysis of agricultural production technologies and management practices related to the many agricultural enterprises important to Michigan farmers; better understand the supply chains of various horticultural products; and identify ethical issues in agriculture.

Results
Information to help agribusiness firms and policy makers understand challenges and opportunities of doing business in a food desert have been published. Collaboration between MSU, Wayne State University and the University of Michigan on Detroit's food deserts is being investigated. The focus has been to assist marketing fresh fruits and vegetables in a food desert.

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The natural beauty and outstanding recreational opportunities provided by Michigan draw more than one million visitors a year. Improving ecological conditions and fisheries has the potential to enhance economic and recreational benefits. For this reason, it is important for natural resources and wildlife managers to understand the recreational demands and economic benefits stemming from these important resources in order to wisely protect, sustain and market them.

What has been done
Research to: develop and extend economic models for estimating consumer preferences and the demand for, and value of, recreational fisheries and wildlife resources; and to study issues related to the management of human resources in a commercial recreation and tourism context.

Results
With the goal of understanding the economic impact of fish and wildlife resources, surveys have been conducted of fishing site choices to develop travel cost valuation models for fishing sites and quality in MI and the Great Lakes Region. Travel cost valuation models for valuing beaches, beach access and the damages from beach closures on the Great Lakes have been presented.

4. Associated Knowledge Areas

KA Code	Knowledge Area
603	Market Economics
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected 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.)

Brief Explanation

The ongoing economic challenges being faced by Michigan -- including the recent federal funding sequestration process -- 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. Although overall research FTEs only decreased by one -- from 65 FTEs to 64 FTEs this past year, we are down from 77.1 FTEs just two years ago.

Specifically, a 15 percent decreases in state funding FY2011-2012 coupled with a flat federal funding line for two consecutive 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 AgBioResearch 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.

These reductions caused some stakeholders to question the commitment of Extension and AgBioResearch to Michigan agriculture. In an effort to address these concerns, leaders from both organizations participated in a series of 13 open forum meetings held throughout Michigan in 2013. Stakeholders and community members asked questions and had the opportunity to learn more about the past decisions and future plans of Extension, AgBioResearch and the MSU College of Agriculture and Natural Resources. It was a valuable exchange between the organizations' leaders and industry stakeholders across Michigan, and helped to ease some tension caused by the cutbacks.

Together, Extension and AgBioResearch continue to serve as the primary research and development arm for the agriculture and food industries in Michigan, valued at more than $91 billion annually.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

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 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.

Additional evaluation results (Extension and AgBioResearch)

MSU Product Center Food-Ag-Bio

Issue (who cares and why)?

Michigan's food and agriculture businesses generate more than $91.4 billion of economic activity annually. MSU Extension and MSU AgBioResearch continue to fuel that growth by collaborating with food- and agriculture-related businesses to ensure they have a well-trained work force and access to services. These services help them identify markets, innovate new products and make critical decisions from product concept to launch.

What has been done

The MSU Product Center Food-Ag-Bio is emblematic of the way Extension and AgBioResearch work one-on-one with entrepreneurs to supply objective, evidence-based methods for starting and growing their businesses. The center was established in 2003 with funds from Extension and AgBioResearch.

Results

In 2012-13, the MSU Product Center advised 482 clients, resulting in:

» 73 venture launches.

» More than $3 million in total capital formation, including $2.5 million of owner investment in Michigan businesses.

» 258 new jobs created or retained

Key Items of Evaluation

Worldwide, farms and other agricultural operations annually produce billions of tons of inedible plant
matter -- crop byproducts with high levels of difficult-to-digest cellulose. Regarded as

having little economic or nutritional value, corn husks, wheat stems, soybean leaves, rice straw, sugarcane leaves and tops, and many other cellulosic materials are usually left on the ground after harvest. That is likely to change, however, thanks to recent technological advances by Michigan State University (MSU) and the Michigan Biotechnology Institute (MBI), a wholly owned subsidiary of the Michigan State University Foundation. MSU AgBioResearch scientist has devoted much of the past 30 years to developing a process to turn cellulosic biomass into an economical source of biofuel and animal feedstock. A process invented by MSU researcher and scaled up for commercial use by MBI, Ammonia Fiber Expansion (AFEX™), allows for the conversion of cellulose-rich plant matter into animal feed and biofuels such as ethanol. If AFEX is successfully commercialized, it will benefit many people. Farmers would gain an additional source of low-cost livestock feed, as well as a new source of revenue by selling their previously discarded crop residues. The energy industry stands to reap substantial
benefits by having a new biofuel source.

Since 1975, the Michigan Department of Natural Resources (MDNR) has worked to eliminate bovine tuberculosis(bTB) from free-ranging white-tailed deer populations. This disease, caused by Mycobacterium bovis, can spread from infected deer to humans and other animal species, especially cattle. Because bTB can affect Michigan livestock industries as well as deer management decisions, baiting guidelines and livestock trade flows, the MDNR and the Michigan Department of Agriculture and Rural Development (MDARD) have taken great measures to reduce disease prevalence in endemic areas of the state.
Collectively, the two agencies have invested more than $86 million in surveillance, control and testing activities to reach and maintain a relatively consistent level of success for more than a decade.
Michigan State University (MSU) AgBioResearch economists are developing a bioeconomics decision theory to help wildlife and livestock managers better understand the economic and epidemiologic trade-offs of disease management actions, equipping them to identify actions with the greatest economic welfare. When diseases spread from wildlife to domesticated livestock, producers often incur significant economic damage from
lost productivity, imposed herd depletions and trade bans. Part of the research explores the economic effect of disease management on trade. One finding is that the relative level of infection is a key driver of trade incentives.

Michigan State University's 5,200-acre campus is primarily powered by the T.B. Simon Power Plant, which burns coal, natural gas and biomass to produce steam that is used for heat and electricity. Coal has been the plant's fuel source since it's inception, but research within the past two decades has shown the harmful byproducts of this energy source. As a result, the university has begun to increase the use of natural gas and biofuel at the plant, and has installed equipment to reduce emissions. The project is aimed at transforming bulky woody biomass into dense, compact forms that have low ash content to minimize the risk of fire, can be easily transported, are water-repellent and can be stored outdoors for extended periods of time. The lab is examining the use of small, pellet-shaped forms of the torrefied material as well as larger sizes in the shapes of briquettes and hockey pucks. There are a lot of groups looking at torrefied material. The new piece is going to be the operating conditions required for the densification system to generate stable pellets, briquettes or pucks. That may involve a number of things from different temperatures during the densification process to binding agents that can hold the pellet together. Making the final material stable is really the new part of the equation, and that's where the research program is headed.

Enhance Michigan's First Green Industry: Agriculture and Agribusiness

Institute

Indicator
Reported
Revenue Protected (Annual Gross Sales) of the businesses that developed and implemented successful business transition plans
$331,256,000
# of business expansions
62
$ tax planning savings, annually
$1,000,132

Greening Michigan: Leveraging Natural & Human Assets for Prosperity Institute

Indicator
Reported
Number of local ordinances amended to accommodate economic development, placemaking, form based coding, Firewise provisions, and other similar measures
16
Number of youth program participants who increase involvement in community issues.
12
Number of community leaders with increased awareness and skills in global or new economy (such as but not limited to placemaking, entrepreneur-friendly, regionalism, and so on).
25
Number of community leaders with increased awareness and skills in measures to prevent damage from wild fire and local regulation to deal with wildfire issues.
62
Number of youth program participants who increase knowledge on tribal, state, and local government.
12
Number of boards who have adopted new or improved rules or processes for compliance
13
Number of participants that report their board used new skills or techniques to improve the effectiveness of their meetings and/or processes at the local or regional level.
184
Number of boards who implement improved citizen engagement strategies.
53
Number of boards who report improved use of data and relevant information to inform their decision making
31
Number of participants who show understanding of relevant laws and the practical impacts of those laws on their boards
233
Number of participants who increase knowledge of their board's structure, functions and duties, and/or operational best practices
394

Number of participants who increase their knowledge of citizen input processes and /or methods to implement those practices
47
Number of participants who can identify and locate resources for quality information and/or apply that information to the solution of problems
151
Number of producers selling at local/regional markets
10
Number of new enterprizes/locals that purchase local/regional food
23
Number of vendors, farm markets, road side stands that accept Bridge Cards, Project Fresh, and participate in Double Up Food Bucks.
20
Number of new diversifying/expanded agri-food businesses developed
46
Number of Community Food Assessments Completed. Gaps in local food system are identified. This helps guide local food work.
2
Number of people with increased knowledge of community food systems. (measured by a quiz and a specific score means knowledge gain. (Short term.)
1,357
Number of people that have an increase in awareness of the goals of the Michigan Good Food Charter.
983
T-A1-I1: Number of people or organizations who reported utilizing the tools
44

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Animal Production and Protection

☑ Reporting on this Program

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	0%		10%	
302	Nutrient Utilization in Animals	0%		13%	
303	Genetic Improvement of Animals	0%		10%	
304	Animal Genome	0%		10%	
305	Animal Physiological Processes	0%		10%	
307	Animal Management Systems	50%		13%	
308	Improved Animal Products (Before Harvest)	5%		1%	
311	Animal Diseases	5%		15%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	0%		2%	
315	Animal Welfare/Well-Being and Protection	10%		11%	
605	Natural Resource and Environmental Economics	20%		5%	
806	Youth Development	10%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	15.4	0.0	6.5	0.0
Actual Paid Professional	14.2	0.0	10.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
619456	0	799372	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
619456	0	830135	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	3774045	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

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. Brief description of the target 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.

3. How was eXtension used?

eXtension was a major part of our multi-state effort (along with work with the North Central Region). In this area, 19 educators responded to Ask an Expert on 164 issues.

Members were activiely involved the following Communities of Practice (CoP) for this area:

Animal Welfare
Bee Health
Beef Cattle
Companion Animals
DAIReXNET
Feral Hogs
Goat Industry
HorseQuest
Livestock and Poultry Environmental Learning Centers
Niche Meat Processor Assistance Network
Sheep
Small and Backyard Flocks

An example in this area is:

Feedlot protocol
Is there a publication on feedlot protocol to help new farmers to understand the steps they have to complete in a feedlot operation? Thank you very much
Reply
As you may have discovered, there are few resources that cover all aspects of feedlot production. A basic, general manual can be found at:

Beef Feedlot Systems Manual - Iowa State Univ.
www.extension.iastate.edu/publications/pm1867.pdf

Most land grant universities in cattle feeding areas have specific information regarding both general and regional specific practices. Examples are Kansas, Texas, Nebraska, Iowa, etc.

If by "protocol" you are refering to environmental regulations, etc, these are primarily state specific, so I suggest contacting the Feedlot Beef Extension Specialist in your state.

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	869	2607	15136	45408

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2013

Actual: 2

Patents listed
MICL02127 - Increasing the efficiency of somatic cell nuclear transfer cloning in bovine - 13/509,111, 11/16/2012. MICL02144 - Functional genomics of probiotic lactobacilli - PCT/SE2013/050646, 6/4/2013.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	2	24	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research programs on animal production and protection.

Year	Actual
2013	40

Output #2

Output Measure

- Number of adult participants trained in animal management systems.

Year	Actual
2013	869

Output #3

Output Measure

- Number of youth participants trained in animal management systems.

Year	Actual
2013	15136

Output #4

Output Measure

- Number of adult participants trained in animal diseases.
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 adult participants with increased knowledge of animal diseases.
4	Number of research programs to understand the processes that control/influence reproduction at the molecular and genetic level.
5	Number of research programs to add to the understanding of various food animal genomes by improving and integrating genetic maps.
6	Number of research programs to develop and evaluate new tools and strategies to detect, prevent and control emerging and reemerging livestock and poultry diseases.
7	Number of research programs to understand the environmental fate and biological effects of vaccines, steroids and other substances fed to animals.
8	Number of research programs to develop and evaluate management/training strategies for horses to reduce injuries.
9	Number of research programs to add to the understanding of animal behavior and welfare.
10	Number of research programs to test new cropping, grazing and feeding strategies for food animals.

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	782

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Meat producers must assure the quality of their food and look for certification programs that maintain and improve both the product and the process.

What has been done
One example in this area is the Pork Quality Assurance program that is a certification program for pork producers. Certification in this program is a requirement for many packing plants and processing facilities and markets are limited if the producers have not achieved PQA Plus certification. MSU Extension educators are the main providers of this program and also providing training for other qualified industry personnel that wish to hold educational sessions.

Results
Evaluation results found that 253 pig producers certified in 2013 protected over $80 million value. This was calculated by the following assumptions:

Number of sows x 23 pigs/sow/year x$150/pig = total protect protected in dollars

23 pigs/sow/year is an average number used

$150 is an approximate value for a market hog sold in 2013

The participants had 23,068 sows in 2013

Note that Quality Assurance programs are renewable on a three year cycle. Regardless of what quality assurance program the operation has received the number of head is only accounted for once in a three year cycle. Numbers are not duplicated.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
311	Animal Diseases

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	13622

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Youth and adult leaders need skills and specific information (based on the area-livestock in this example) in teaching others. The continued development and maintenance of the livestock industry requires continued research and education to keep the field vital and healthy.

What has been done
One example is MSU Extension developed the 4-H Beef, Sheep, & Swine Leaders Workshop that was co-sponsored by the Michigan Pork Producers Association and by generous donations to the Michigan 4-H Foundation. This workshop was open to teen (aged 13 and older) and adult leaders involved with beef, sheep, and swine projects. The goals of the workshop were:

Teach skills in areas of practical livestock production and management.

Develop communication skills and leadership techniques for participants in order to more effectively re-teach skills in the county.

Offer an opportunity to share with others, programs that have been successful in other counties.

Develop methods to encourage youth and their families to participate in 4-H clubs and other Extension activities.

Results
Evaluation results found:

100% of the participants agreed or strongly agreed that they were more knowledgeable about livestock sciences.

91% said they felt more knowledgeable about entrepreneurship and career opportunities for youth to pursue in science related fields.

99% plan on applying the science knowledge and skills from this workshop.

51% indicated that this training helped them understand how to teach youth using a hands-on ?learning-by-doing? approach.

55% indicated that after this training they understood how to teach youth using an inquiry ?question-asking? approach.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
311	Animal Diseases
806	Youth Development

Outcome #3

1. Outcome Measures

Number of adult participants with increased knowledge of animal diseases.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Unless you are a strict vegetarian or lactose intolerant, chances are that dairy and beef products make up half of your diet. According to the U.S. Department of Agriculture, almost 40 percent of the average American diet is dairy, and beef makes up 10 percent. This makes these products an integral part of our lifestyle and our economy, this sustained productivity and animal health are critical issues to the cattle industry.

What has been done
Research to: understand the impact of animal agriculture on the modern society; develop new methods to improve fertility and reproductive efficiency in livestock; investigate potential effects of exposure to environmental contaminants in humans and animals, with an emphasis on reproductive performance; develop a local/regional pasture-based beef production system encompassing the entire beef production chain; and to assess the impact of Ovsynch on conception rates of lactating dairy cows.

Results
Researchers have demonstrated for the first time that mild undernutrition during early pregnancy did not alter birth weight or growth, but had a marked negative impact on blood pressure and heart anatomy in offspring. This finding is significant because it shows the importance of proper nutrition during early pregnancy on the cardiovascular system in cattle.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
303	Genetic Improvement of Animals
304	Animal Genome
305	Animal Physiological Processes
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

Outcome #5

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Genetic maps are an integral part of several statistical models that are commonly used to find disease genes. A better understanding of these maps will allow for the development of increasingly accurate models that will provide researchers and producers with reliable estimates in a practical amount of time and will greatly enhance disease prevention and treatment efforts.

What has been done
Research to: develop methods for producers and consultants to evaluate dairy herd performance and assess trends for herd life and culling rates;develop a new set of tools and reagents to study autologous cell therapy using a new large animal model; and to develop and adapt staistical and computational methods to link phenotypic variation to genomic variation.

Results
Visitor biosecurity practices were used on 5 farms in 2013 as part of the Michigan State University Extension "Breakfast on the Farm" program. This farm tour program provides the public access to modern dairy and crops farms and involved over 11,000 participants. Incorporating visitor biosecurity measures for these tours reduced the possibility of someone returning from a foreign country and coming into contact with livestock and lowered the risk of kids and adults carrying harmful bacteria home. The effort also exposes the public and more producers and agribusiness professionals to visitor biosecurity concepts.Educational farm tours provide the public an opportunity to see modern farm operations first-hand, learn about current animal management practices and technology being used and ask questions of farmers who volunteer to help with these events. For dairy operations, they come away with a better understanding of modern dairy farms and a positive impression about how milk is produced, the environment is cared for and how animals are cared for, housed and managed. In general, the percentage of respondents with positive or very positive impressions increased from 60-65% to 90-97% as a result of their
visit to one of the educational Breakfast on the Farm events. These events provide an opportunity to learn what participants think and what their concerns are after their visit through their comments and responses in exit surveys. On-line surveys indicate that about 20% of of the BOTF participants are purchasing more milk, cheese and yogurt as a result of their participation in a BOTF event.

4. Associated Knowledge Areas

KA Code	Knowledge Area

304 Animal Genome

305 Animal Physiological Processes

Outcome #6

1. Outcome Measures

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. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Animal disease in the United States could seriously damage the livestock and poultry industries. For example, eradication of avian influenza in the United States following an outbreak in the mid-1980's resulted in the destruction of 17 million birds and cost taxpayers nearly $65 million. The collective effort and vigilance of researchers, livestock producers, veterinarians and state and local government officials is needed to ensure adequate disease surveillance and to provide the needed resources to prevent, respond and/or eliminate disease outbreaks.

What has been done
Research to: develop new interventions to reduce antimicrobial resistance when treating animals with antimicrobial drugs and to develop a new non-antibiotic treatment for mastitis in dairy cows; determine the contribution of T2SS to biofilm formation in gram-negative human and plant pathogens' better understand parasitic and mutualistic interactions in a bacteria-nematode insect association; collect and screen for bacterial strains with antagonistic properties for food borne pathogens and test their efficacy; and improve immune recognition in order to protect against or eliminate viruses and diseases such as Johne's disease.

Results
Researchers detected epizootic hemorrhagic disease virus (EHDV) in cattle showing clinical sign of disease. This virus had not been detected in cattle until this year in Michigan. Detection of that virus in MI is evidence of a recent expansion in the virus range in the US. Characterization of the EHDV detected revealed that it was a serotype 3 virus.

Researchers explored temporal changes in antimicrobial resistance in dairy cattle. Results suggest that the state of production may have an effect on shedding of coliforms and resistant coliforms. They also looked at probiotics as an intervention to reduce antimicrobial resistance in pre-weaned dairy calves. Investigators also looked at manuka honey and oregano as an alternative non-antibiotic treatment for mastitis in dairy cows.

4. Associated Knowledge Areas

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

Outcome #7

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Michiganders are an exceptionally vulnerable population due to their chronic exposure to complex mixtures of endocrine disruptors, which include legacy environmental contaminants (e.g., dioxin, PCBs, DDT) within the Great Lakes basin. A comprehensive molecular and physiological understanding of the interactions that may occur is critical to human health. Also, vaccines, steroids, antibiotics and other substances are added to animal feed to improve growth rates by controlling parasitic and bacterial diseases. With the recent major expansion in concentrated animal feedlot operations, the potential risks from these operations must be assessed.

What has been done
Research to: achieve a better understanding of the impact of animal agriculture on society by integrating the risks and benefits related to economics, environmental protection and human

health; develop multistage hierarchical models to facilitate greater efficiency of inference in general mixed model microarray experiments; and to identify the environmental transformations undergone by animal feed additives and determine their environmental fate.

Results
Researches have been promoting better stewardship of antibiotic use on dairy farms, focusing on reducing unwarranted use of antibiotic therapy for the treatment of mastitis. They have created a dedicated website, seminars and presentations for dairy producers and veterinary practitioners.

4. Associated Knowledge Areas

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

Outcome #8

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Due to improvements in nutrition, management and health care, horses are living longer, more useful lives. It's not uncommon to find horses and ponies living well into their 20s and 30s. Although genetics play a determining role in longevity, providing proper care and nutrition plays a key role in horses' health, performance and overall well-being.

What has been done
Research to: investigate ways to manipulate bone density and strength through mechanical loading to help prevent injuries to performance horses and increase the longevity of livestock; identify ways to manipulate the equine diet to optimize skeletal health and improve the overall welfare of horses; and to define the role that EHV-5 plays in the development of spontaneous

equine multinodular pulmonary fibrosis.

Results
Researches found that mature exercising horses free from osteoarthritis do not exhibit physiological anti-inflammatory benefits when supplemented with a low dose of omega-3 fatty acids over a 21-d period. This study suggests a higher dose of DHA may need to be offered. Based on this study and prior work completed by this laboratory, we can conclude that NSAIDs substantially contribute to EGUS and an unknown level of gastric permeability but no difference between organic and inorganic minerals in the prevention or healing rate of EGUS was detected.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #9

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Our society has placed increased emphasis on the welfare of research and exhibit animals. U.S. law now requires attending to exercise requirements for dogs and the psychological well-being of non-human primates. Animal welfare without knowledge is impossible. Animal behavior researchers look at the behavior and well-being of animals in lab and field. Good animal welfare requires solid science that informs and directs policies and practices related to disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling and humane slaughter.

What has been done

Research to: maintain and improve skeletal health in livestock and companion animals; identify management practices and environmental conditions, particularly for young animals, that allow expression of positive natural behaviors while improving animal welfare in the context of environmentally sustainable production systems; and to examine ethical issues in agriculture.

Results
With the long term goal of identifying management practices and environmental conditions, particularly for young animals, that allow expression of positive natural behaviors while improving animal welfare in the context of environmentally sustainable production systems, researchers explored laying hen behavior in aviaries as well as sensor development for monitoring hen behavior. They are also examining the impact of stocking rate in dairy cattle.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #10

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	11

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As production costs rise, environmental concerns increase and consumer expectations become higher, those involved in the agrifood industry are looking for ways to maximize reproductive and performance efficiencies in a way that is economically and environmentally sustainable, and that protects human and animal health.

What has been done
Research to: develop a local/regional pasture-based beef production system encompassing the entire beef production chain; investigate strategies to maximize milk production output and ecosystem functions in grazing dairy systems; mitigate the environmental footprint of animal

systems; develop a local/regional pasture-based beef production system encompassing the entire beef production chain; investigate strategies to maximize production output (milk)and ecosystem functions (processes and services) in grazing systems managed under various scenarios for the optimization of automatic milking and pasture systems; better understand the mineral needs of the pig; and to evaluate the effectiveness of mannaniligosaccharides on egg production, egg weight and bird livability of laying hens.

Results

Iron in drinking water: There was no main effect of treatment on any response variables. There was an effect of hour pooled across treatments on serum iron, UIBC, percent iron saturation; and, for liver Cu and Zn concentrations. There was a treatment by time interaction for serum Zn concentration and a tendency for liver Cu concentration. Results indicate that infusion of ferrous iron at rates used in this study do not have major impacts on short-term iron status of lactating dairy cows.

We have been able to determine the presence of Zn transporters in pigs and will be able to use this information to more accurately quantify their Zn requirement. Additionally, we now know more about the requirement of pigs fed agents that promote increased muscling. The interaction of nutrients is important in meeting the animal's needs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)

V(H). Planned Program (External Factors)

External factors which affected 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.)

Brief Explanation

The ongoing economic challenges being faced by Michigan -- including the recent federal funding sequestration process -- 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. Although overall research FTEs only decreased by one -- from 65 FTEs to 64 FTEs this past year, we are down from 77.1 FTEs just two years ago.

Specifically, a 15 percent decreases in state funding FY2011-2012 coupled with a flat federal funding line for two consecutive 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 AgBioResearch 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.

These reductions caused some stakeholders to question the commitment of Extension and AgBioResearch to Michigan agriculture. In an effort to address these concerns, leaders from both organizations participated in a series of 13 open forum meetings held throughout Michigan in 2013. Stakeholders and community members asked questions and had the opportunity to learn more about the past decisions and future plans of Extension, AgBioResearch and the MSU College of Agriculture and Natural Resources. It was a valuable exchange between the organizations' leaders and industry stakeholders across Michigan, and helped to ease some tension caused by the cutbacks.

Together, Extension and AgBioResearch continue to serve as the primary research and development arm for the agriculture and food industries in Michigan, valued at more than $91 billion annually.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

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 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.

Additional MSU Extension Evaluation results include:

State 4-H Veterinary Science Leaders Workshop

Issue (who cares and why)?

Youth and adult leaders need skills and specific information (based on the area-livestock in this example) in teaching others. The continued development and maintenance of the livestock industry requires continued research and education to keep the field vital and healthy.

What has been done

One example is MSU Extension developed the State 4-H Veterinary Science Leaders Workshop.This workshop was open to teenss (aged 13 and older) and adult leaders interested in veterinary sciences. Sponsorship was made possible by generous donations to the Michigan 4-H Foundation.

This conference is designed to:

· To present new ideas, activities, and approaches to the 4-H Veterinary Science Program.

· To give conference participants opportunities to explore new ideas in-depth and get a "hands-on" experience.

Participants had 7 contact hours with 18 MSU faculty along with 6 industry representatives and other volunteer resource people.

The students spent 2 days exploring ideas, research and hands-on activities related to veterinary science. Youth and adult participants were given the opportunity to attend a variety of sessions: Real Situations in Veterinary Medicine, Animal Care and Welfare: Why Should You Care?, Science, Animals, Medicine and You, Critical Health, Welfare, and Care with Endurance Horses, Skeletal Problems in Dogs and Cats, How Do I Get Into Vet School?, Artificial Insemination with Beef and Dairy Cattle, Top Ten Cattle Health Achievements of the Past Decade, Dissection: What is That Organ?, How Do I Become A Veterinary Technician?, Transporting Your Animals: What Tests Do They Need?, Ask the Vets and Vet Students.

Results

142 total participants attended - 25 males and 117 females representing 29counties. 91 youth participated along with 51 adults. 60% were first-time participants and 40% have attended 2 or more times.

Impacts from the evaluation were:

· 99% of the participants agreed or strongly agreed that they were more knowledgeable about veterinary sciences.

· 91% said they felt more knowledgeable about entrepreneurship and career opportunities for youth to pursue in science related fields

· 97% plan on applying the science knowledge and skills from this workshop

· 58% of participants indicated that this training helped them understand how to teach youth using a hands-on "learning-by-doing" approach.

· 45% shared that they teach youth using a hands-on "learning-by-doing" approach.

· 58% indicated that after this training they understood how to teach youth using an inquiry "question-asking" approach.

· 55% said they teach youth using an inquiry "question-asking" approach.

Comments from Participants

"This workshop taught me more about animals and different careers in veterinarian medicine."
~Clare County

"I found this workshop to be extremely beneficial. I was excited by how much hands-on work we got."
~Gratiot County

"I really enjoyed this workshop. It gave me hands-on experience in a field I would love to pursue."
~Missaukee County

Feeding the Beef Cow Herd in 2013 and Beyond

Issue (who cares and why)?

Beef farmers need up-to-date information on managing risks and new practices to help profitability.

What has been done

MSU Extension developed several sessions to help beef producers that included: The Changing Face of the Michigan Cow Calf industry; Industry Perspective; Simple Methods to Estimate Winter Beef Cow Feed Needs; and Keeping the Beef Cow Feed Budget under Control with Alternative Feeds.

Results

Evaluation results found:

83% planned to adopt new managment practices. The most common explanations for a yes answer had to do with managing feeding practices. Thirteen of the respondents mentioned feed specifically, with details ranging from the addition of cornstalk and alternative feed sources to testing feed or lowering the cost of feed. Some participants mentioned cover-cropping and double or triple cropping or checking on what the neighbors are setting aside. Finally, some mentioned new practices or managing of cattle.

72% responded they would implement new technology. Participants mentioned they would be using the "cowculator," use of computer programs, and spreadsheets. Other

technology listed included smart phone apps and feed testing.

55% planned to make management changes to protect against risks that included: planning ahead, testing feed and using cornstalks.

62% planned to adopt technology or tools to manage risks by testing feed and balancing rations as well as use of the cowculator and spreadsheets.

Key Items of Evaluation

The European Union passed a law in 2012 that requires all commercial eggs to be produced in free-range barns or enriched cages, thus essentially banning conventional housing for hens. Several U.S. states have already passed legislation to change hen housing. The Michigan Animal Industry Act, passed in 2009, gives producers 10 years to adopt the new standards. The law doesn't ban conventional housing, but says hens need to be able to stretch their wings without coming into contact with the cage, freely movearound and lie down. Researchers looked at hen health and behavior in the cage-free aviary systems. For this aspect of the project, researchers studied two large flocks of hens over two years at a commercial egg-laying operation.
Preliminary findings show that workers in the cage-free aviary houses were exposed tohigher levels of dust and bacteria than those working in the conventional cage or enriched colony housing. This increased exposure is due in part to the effects of litter that accumulates on the floor in aviary housing. Egg quality was
the same in all housing systems. The next steps include assembling guidelines describing the positives and negatives of what researchers observed, as well as additional computer tools to help producers decide
which housing system works best in their operations.

Locally produced foods are a small but growing facet of U.S. agricultural sales. The U.S. Department of Agriculture (USDA) estimates that the farm-level value of local food sales totaled $4.8 billion in 2008, less than 2 percent of the U.S. market for agricultural products. An estimated 107,000 farms are engaged in local food systems, or about 5 percent of all U.S. farms. Researchers are looking at ways to beef up those numbers -- literally. Although consumers are increasingly demanding locally sourced food products, they have little choice at the supermarket, especially in protein selection. In fact, a mere handful of
corporations control about 90 percent of global meat distribution. Researchers have developed a local
food system model in the Lake City area that includes 20 local cattle producers who will each provide 10 steers as part of the project. Three of the participating producers are working to convert more than 1,000 acres to a pasture-based model, As part of the local food system model, researchers have also partnered with a local family-owned grocery store where some of the cattle will be sold. Called a "pasture-to-plate" concept with substantial potential to benefit the local economy. A University of Kentucky study that reveals that every $1 spent on beef cattle production returns $3.50 to the local community. Using that multiplier, the 200-steer project could equate to as much as $500,000 to the surrounding area.

Enhance Michigan's First Green Industry: Agriculture and Agribusiness Institute

Indicator	Reported
# of farms adopting practices that manage risks	1,119
# of farms adopting technology or tools to manage risks	293
# of animal units adopting practices to increase yield, improve quality, or decrease inputs	6,741

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

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

☑ Reporting on this Program

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%		5%	
402	Engineering Systems and Equipment	0%		10%	
404	Instrumentation and Control Systems	0%		9%	
501	New and Improved Food Processing Technologies	0%		10%	
502	New and Improved Food Products	0%		15%	
503	Quality Maintenance in Storing and Marketing Food Products	10%		14%	
504	Home and Commercial Food Service	20%		0%	
511	New and Improved Non-Food Products and Processes	60%		16%	
512	Quality Maintenance in Storing and Marketing Non-Food Products	0%		9%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	10%		12%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Actual Paid Professional	3.6	0.0	5.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
164688	0	456784	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
164688	0	474363	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	2156597	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research to: provide that state with a foundation for the vigorous development of a strong biobased economic sector; identify breeding and genetic improvement related to food quality, nutrition and processing; identify and isolate beneficial plant compounds and develop the processes and technologies to manufacture functional foods; develop new biosensors, RFID tags and other technologies for track, trace and security issues; enhance the economic and nutritional value of food products through post-harvest and food processing technologies; and develop sustainable packaging systems to enhance food quality and shelf life.

- Improved technology at the farm scale.
- Assisted in policy development in bioenergy area.
- Reduced food safety issues for producers delivering food to markets and communities.
- Helped farmers develop new bioproducts and markets for bioproducts.
- Increased adoption of bioenergy technologies.
- Reduced food safety issues for food handlers in restaurants and food markets through educating about cooking temperatures and proper storage.

2. Brief description of the target 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.

3. How was eXtension used?

eXtension was a major part of our multi-state effort (along with work with the North Central Region). In this area, 13 educators responded to Ask an Expert on 77 issues.

Members were activiely involved the following Communities of Practice (CoP) for this area:

Sustainable Ag Energy
Wood Energy
Food Safety

A example is:

Methane gases produced and used on the farm

We have several large farms in Barry County. Has research been done on harvesting the methane gases produced from our Michigan farms? What are the overhead costs and potential of using such fuels? Whom can I contact with more questions?

Reply

Yes, there has been quite a bit of research done on harvesting methane from manure and food-processing waste. There is one dairy farm in Barry County that has an anaerobic digester (AD) already installed and operational. They collect methane and can either combust it in an engine to generate electricity, or they can scrub it (remove excess moisture and hydrogen sulfide) and pipe it into natural gas pipelines.

Right now, an AD is cost-effective only on larger farms that can afford to invest a few million dollars into them. There is research going on now to figure out a way to scale down this technology in a way that will still be economical to install and operate.

Depending on your questions, I might not be the right person to ask, but I can certainly put you in touch with someone who can answer your questions. I would suggest you give me a call or drop me an email.

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	536	1608	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2013
Actual:	18

Patents listed
MICL02185 - Nanostructured interfaces for biocalalysis - PCT/US2012/053958, 09/06/2012; 8,435,773, 05/07/2013. MICL02189 - Bioderived fuels and chemicals: facilitating development through property characterization - 8,293,935, 10/23/2012. MICL02289 - Thermochemical conversion of plant biomass to liquid and solid fuels - 61/717,804, 10/24/2012; PCT/US2013/29044, 03/05/2013; 61/798,598, 03/15/2013. MICL02291 - Bioreactor engineering for gas-intensive fermentations to product biobased fuels and chemicals - PCT/US2012/053958, 09/06/2012; 8,435,773, 05/07/2013. MICL01706 - Interactions of biological macromolecules at fluid-like interfaces - 8,435,773, 05/07/2013. MICL02007 - Development of Nano-Structured biosensors for rapid detection of disease-causeing agents in food and water - 13/670,630, 11/07/2012; 61/674,485, 07/23/2012; 61/762,618, 002/08/2013, 61/763,142, 02/11/2013; PCT/US2013/040713, 05/13/2013, 8,287,810, 10/16/2012. MICL02240 - Molecular mechanisms associated with turkey skeletal muscle growth and meat quality - 8,337,914, 12/25/2012. MICL02111 - Characterizing packaging systems through assessment of mas transfer and degradability of biopolymers - PCT/US2012/047199, 07/18/2012. MICL02217 - Evaluation, Development and Implementation of sustainable packaging systems - PCT/US2012/047199, 07/18/2012.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	24	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of adults trained in bioenergy crops.

Year	Actual
2013	536

Output #2

Output Measure

- Number of research programs in food quality, nutrition, engineering and processing.

Year	Actual
2013	24

Output #3

Output Measure

- Number of food handlers that increase their knowledge about food safety.

Year	Actual
2013	420

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of research programs to connect Michigan industries with research, education and entrepreneurial activity needed in the basic sciences, engineering, plant science and agriculture to provide the state with a foundation for vigorous development of a strong bio-based economic sector.
2	Number of research projects to develop the processes and technologies to manufacture functional foods.
3	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.
4	Number of research programs to identify breeding and genetic improvement related to food quality, nutrition and processing.
5	Number of research programs to develop packaging systems to enhance food quality and shelf life.

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Michigan, along with many other states, continues to work on revitalizing its economy. A critical component of the state's and the nation's revitalization effort is to decrease dependence on foreign oil, while creating jobs and encouraging further alternative energy investments. These efforts will have a significant impact on agriculture and manufacturing throughout the Great Lakes region and beyond, as sustainable alternatives to petroleum-based products are developed to strengthen the state's economy.

What has been done
Research to: develop innovative bioelectrocatalytic converters that achieve mediated electron transfer to dehydrogenases and optimize the reactor's performance for coupled bioconversions having commercialization potential; and to facilitate the development of bio-derived fuels and chemicals through property characterization.

Results
Our researchers have published information regarding biofuel blends and methods for upgrading bioderived products.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products

511 New and Improved Non-Food Products and Processes

Outcome #2

1. Outcome Measures

Number of research projects to develop the processes and technologies to manufacture functional foods.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Dwindling farm acreage, more expensive production and processing costs, and increased consumer expectations have prompted research into creating new - and enhancing existing - processes and technologies that manufacture healthy, functional foods. More significant, perhaps, is the potential of functional foods to mitigate disease, promote health and reduce health care costs.

What has been done
Research to: identify, develop and/or apply technology to ensure that the Michigan fruit, vegetable, chestnut and canola oil industries remain economically and environmentally sustainable; develop and process dairy foods that are consistent with the benefits of ingesting probiotics; develop improved methods for the design and operation of thermal processing systems for protein foods; develop technologies to support management systems for quality grains and oil seeds; evaluate the efficacy of processes and ingredients that impact known safety hazards in muscle foods; and to pursue new process technology for raw material pretreatment, fermentation, distillation and aging related to artisan distilling.

Results
Yogurt and pasteurized liquid cow's mile were fortified with ferrous bisglycinate, ferrous lactate and ferrous sulfate microencapsulate. After analysis for taste, appearrance, flavor and nutritional value it was determined that ferrous sulfate micorencapsulate was the best option fortifying both yogurt and pasteurized liquid milk.

Researchers were able to show the ability for listeria to cross contaminate large numbers of onions with mechanical slicing to help in rick assessments for fresh-cut produce. They also investigated the impact of packaging atmosphere and package size, areas of cantaloupe and

honeydew melon rind and product temperature; and impact of slicer design on the growth of listeria. These results will be key in the development of science based transfer models for risk assessments.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products

Outcome #3

1. Outcome Measures

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. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The rapid detection of harmful organisms and disease-causing agents in food and water, and the ability to track and trace sources is critical to human health. In the food safety arena, it is estimated that 48 million food-borne illnesses occur each year in the U.S., accounting for 128,000 hospitalizations and more than 3,000 deaths. Biosensors can play a key role in food safety by quickly identifying contaminants in water supplies, food processing and assembly lines, raw food materials and food products before they cause problems further up the food chain.

What has been done
Research to: Synthesize, characterize and evaluate nanostructured interfaces that enable molecular level investigations of systems of medical, scientific and technological interests; investigate using radio frequency identification (RFID) in tracking, traciig and security issues related to the movement of goods through the supply chain; and to combine the novelty of nanoscale transducing material and biosensing techniques to address the detection and diagnostic challenges in food and water safety.

Results
Researchers are developing three new protocols for communication between host servers and RFID readers, and between RFID readers and RFID tags. This will enable a high degree of security for wireless transmission of data as well as wire-based transmission. Another project is using RFID readers and tags in timing how long consumers and users visually inspect their packaging for relevant information. We are also tracking processed beef cattle from field to fork via RFID ear tags and the use of barcodes inside and during the processing plant. The finished packages of beef are then delivered to MSU dining halls.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
404	Instrumentation and Control Systems
503	Quality Maintenance in Storing and Marketing Food Products

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Genetic diversity is required to meet certain production needs in plant and animal agriculture to allow for sustained genetic improvement and to facilitate rapid adaptation to changing breeding objectives. Recent efforts in gene discovery and functional genomics are providing the necessary understanding to develop and evaluate different approaches to manipulate phytochemical composition.

What has been done
Research to: determine the impact of heat stress on meat quality; help address the detection and diagnostic challenges in global health, biodefense and food/water safety; assess the risk of

humans to mycotoxins via food-borne and air-borne exposure and develop appropriate mitigation strategies; understand the process of E. coli chromosomal DNA replication and its regulation at the biochemical level; identify protein markers that are indicators for soft wheat processing quality; limit human exposure to aflatoxin in food to help prevent liver cancer; characterize the role of hypoxia in metal-induced toxicity; and to develop innovative processing that adds value to fresh or processed meat products.

Results
Researchers have successfully shown that both HIF1a and HIF2a are important for the normal development in immunity of the lungs. They have demonstrated that the abnormal innate immunity brought on by the loss of HIF1a or HIF2a can be mimicked by the neonatal exposure to hyperocxia. Recent research has linked HIF-dependent chant in immunity to alteration in a critical immunomodulatory protein that has recently been shown to play a roll in asthma etiology. These results suggest pharmacological intervention targeting the hypoxia signaling cascade might be a viable option for the treatment of illness associated with prematurity, such as brochopulmonary dysplasia and atopic disease such as asthma.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products

Outcome #5

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In packaging systems, chlorine dioxide gas is used for vapor-phase decontamination in treating produce before packaging and sanitizing products inside their packages. Yet very little is known about its effects on packaging material properties and performances. In terms of the containers themselves, use of a reusable, plastic-based packaging system would greatly reduce the costs

associated with packaging and address environmental issues.

What has been done
Research to: Promote functional and sustainable packaging systems that optimize the utilization of raw materials; and to develop and use new types of packaging systems for fruits and vegetables.

Results
Research to create a new packaging material produced from renewable resources so that the overall environmental footprint of the packaging system can be minimized. A new polymeric structure has been created. This is a new biobased renewable structure based on poly (lactic acid) -PLA - and thermoplastic cassaca starch - TPCS - was developed. New membranes based on PLA and metallic organic framework are being produced and assessments on the environmental footprint of packaging systems are being carried out.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
503	Quality Maintenance in Storing and Marketing Food Products

V(H). Planned Program (External Factors)

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

Brief Explanation

The ongoing economic challenges being faced by Michigan -- including the recent federal funding sequestration process -- 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. Although overall research FTEs only decreased by one -- from 65 FTEs to 64 FTEs this past year, we are down from 77.1 FTEs just two years ago.

Specifically, a 15 percent decreases in state funding FY2011-2012 coupled with a flat federal funding line for two consecutive 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 AgBioResearch 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.

These reductions caused some stakeholders to question the commitment of Extension and AgBioResearch to Michigan agriculture. In an effort to address these concerns, leaders from both organizations participated in a series of 13 open forum meetings held throughout Michigan in 2013. Stakeholders and community members asked questions and had the opportunity to learn more about the past decisions and future plans of Extension, AgBioResearch and the MSU College of Agriculture and Natural Resources. It was a valuable exchange between the organizations' leaders and industry stakeholders across Michigan, and helped to ease some tension caused by the cutbacks.

Together, Extension and AgBioResearch continue to serve as the primary research and development arm for the agriculture and food industries in Michigan, valued at more than $91 billion annually.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

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 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.

MSU Extension Evaluation results in this area. (Note activities around bio-energy is new, especially for youth)

4-H Discovery Camp

Issue (who cares and why)?

Youth and adults are needing more information and opportunties in understanding the emerging field of bio-energy.

What has been done

MSU Extension developed the 4-H Discovery Camp for youth ages 13 to 19 to:

· Educate youth on current issues and technologies impacting energy and the environment within Michigan's agriculture sector.
· Develop problem solving and critical thinking skills through team work and hands-on-

learning.
· Expose youth to degrees and jobs in these new and exciting fields.
· Develop and expand career and personal interests.
· Foster participants' ability to meet new people and make new friends from different places and backgrounds.
· Develop social and academic skills needed for a successful transition to college and life as an adult.

Sponsorship was provided from the Michigan Corn Growers Association and the Michigan Soybean Promotion Committee. Participants had 35 contact hours with 16 MSU faculty and educators along with 10 industry leaders.

The students spent 5 days exploring ideas, research and hands-on opportunities in the field of energy as it relates to natural resources and agriculture. They worked with leading researchers at MSU who are developing the latest innovations in biofuel production and technology that offer alternatives to fossil-based fuels. The teens also visited companies that are taking the latest discoveries of science and turning them into real products that impact our local communities and the world. They toured and did hands-on activities at MSU Recycling Center, Kellogg Biological Station, MSU Kellogg Bird Sanctuary, Carbon Green Bioenergy and a substation specialized in the transfer of wind energy. Youth also conducted experiments, made their own biofuel and designed, tested and raced solar power cars. Participants were also granted access to many of the resources that MSU campus has to offer, including many lab tours and faculty presentations. They stayed in an MSU residence hall.

Results

· 95.3% of the participants who responded to the evaluation reported that after completing this camp they are more knowledgeable about Bioenergy
· 73% of participants also indicated that they are more likely to pursue a degree or career in a Bioenergy related field following the completion of this camp.
· 68% indicated an anticipated change in personal energy use.
· 86.1% plan to apply the knowledge gained through the program.
· 71% plan to teach what they have learned to others.

Key Items of Evaluation

That said, the most notable qualitative impacts realized in this program were:

In 2009, the Centers for Disease Control and Prevention (CDC) reported a Salmonella outbreak in peanut products that spanned 46 states, caused 714 people to become ill, contributed to approximately nine deaths and resulted in one of the largest food recalls in U.S. history. More than 3,900 products were pulled from the nation's shelves, and peanut producers estimated a loss of $1 billion in production and sales. Salmonella outbreaks in low-moisture foods -- such as tree nuts, soy, wheat flour, black pepper and dry hydrolyzed vegetable protein -- are an emerging issue prompting ingredient manufacturers to develop

processes that reduce the risk of Salmonella contamination. We're most often concerned about the bacteria being in foods such as raw meat or poultry, but it turns out that Salmonella is very adept at surviving in
dry foods. It will not grow in them, but it becomes much more difficult to kill. The time-temperature combination necessary to kill the bacteria can be nearly 100 times greater in low-moisture foods than in high-moisture foods. we don't know how the relationships between bacterial resistance and moisture content, fat content, structure, humidity or temperature affect the validity of the treatment process. Many low-moisture foods are physically modified and used as ingredients. Marks explained that it's nearly impossible to run tests with every low-moisture food in its various states, so it's imperative to identify
the characteristics that could have the greatest effect on the validity of a process.We want to generate tools and models that can be generalized and applied to a range of products.

Enhance Michigan's First Green Industry: Agriculture and Agribusiness Institute

Indicator
Reported
Amount of fossil energy displaced by bioenergy, BTU's
2,890,011

Improving Health and Nutrition Institute

Indicator
Reported
Number of participants that gain knowledge in cross- contamination
636
Number of participants that gain knowledge in safe temperatures for cold and hot foods/cooling hot foods and storing temperatures
674
Number of participants that gain knowledge in preserving foods including canning methods for low and high acid foods and methods for freezing and dehydrating foods.
825
Number of participants with improved awareness, knowledge, and skills of personal hygiene (such as hand washing), cooking and storing food adequately, and avoidance of cross contamination, keeping foods at safe temperatures, and avoidance of foods from unsafe sources.
670
Number of participants with improved knowledge and awareness of the importance of following USDA food preservation guidelines including proper processing of low acid and high acid foods, correct processing times, selection of food for preservation, using tested recipes, freezing & dehydrating foods.
834

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Global Food Security and Hunger

☐ Reporting on this Program

Reason for not reporting

Went back to original six state plans and incorporated old NIFA Priorities back into these main areas.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	10.2	0.0	8.0	0.0
Actual Paid Professional	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research programs to:

• Genetically improve dry beans, rice, soybean, wheat, vegetable crops (e.g., potatoes, tomatoes) and fruits (e.g., strawberries, blueberries, tart and sweet cherries) for yield, pest resistance and food quality.
• Better understand the processes and factors that influence the growth, meat quality and other economically important traits in food animals.
• Increase the efficiency of milk production in dairy cattle
• Identify current and emerging public policy issues on trade, environmental, agricultural and food issues to ensure food access and security to all.
• Develop strategies and approaches that enhance the sustainability of vegetable production systems.
• Identify beneficial plant-microbe interactions and soil properties and their influence on crop yield.

Extension and outreach activities to:

Financial tools instruction such as enterprise analysis, partial budgeting, breakevens, and cost of production (including Annie's Project)

Resources for growers scaling up production to new markets (local through global) to include:

• Applied market demand research (local through global)
• Target market research and education
• Pricing strategies
• Facilitating grower/buyer relationships

Marketing strategies and information on emerging and evolving business practices and market structure throughout the food supply chain

Active market research on the global market for Michigan products, including distribution, tariff and tariff compliance issues, food safety and global standards compliances, and identification of opportunities for Michigan products.

Commodity marketing for commercial production agriculture producers

Provide support to farmers and other land owners in understanding and negotiating contracts, leases and agreements (mineral, right-of-way and wind power).

Labor/ employee management training

Business succession and estate planning training (incl Annie's Project)

Demonstrate food production and distribution model that directly engages producers on a local/regional scale teaming with modest size food processing facilities and large scale institutional and private-industry consumers.

Conduct and publish applied research in support of value added agriculture on local, multi-state and national levels

Risk Management Tools Including Crop Insurance, USDA Programs(Farm Bill) ACRE, SURE
Development of and information sharing related to Agricultural Policy

Support for start-ups, including limited resources and minority farmers and their employees.
Identify local experts to network with new start-ups.

2. Brief description of the target audience

Agricultural producers (crop and livestock), commodity groups, state agency representatives, food chain supply industry representatives, state and federal elected officials and policymakers, national and international policy and standards boards and councils, and the interested public.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2013

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	32	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research programs on global food security and hunger.

Year	Actual
2013	0

Output #2

Output Measure

- Number of producers and processors trained in national and international policy issues that impacts the industry competitiveness.

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of research programs that deal with the genetic improvement of key agricultural crops related to yield, quality, drought/cold tolerance and pest resistance.
2	Number of research programs to understand the processes and factors that influence growth, meat quality and production efficiencies in food animals.
3	Number of research programs to identify current and emerging key public policy issues on trade, environmental, agricultural and food issues.
4	Number of research programs to develop strategies and methods that enhance sustainability and reduce risk for agricultural systems.
5	Number of producers and processors with improved understanding of national and international policy issues and the impacts on their own firm and industry competitiveness.

Outcome #1

1. Outcome Measures

Number of research programs that deal with the genetic improvement of key agricultural crops related to yield, quality, drought/cold tolerance and pest resistance.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Number of research programs to understand the processes and factors that influence growth, meat quality and production efficiencies in food animals.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #3

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #4

1. Outcome Measures

Number of research programs to develop strategies and methods that enhance sustainability and reduce risk for agricultural systems.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #5

1. Outcome Measures

Number of producers and processors with improved understanding of national and international policy issues and the impacts on their own firm and industry competitiveness.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area

{No Data} null

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Climate Change

☐ Reporting on this Program

Reason for not reporting

Went back to original six state plans and incorporated old NIFA Priorities back into these main areas.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	5.0	0.0	4.0	0.0
Actual Paid Professional	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research will be undertaken to: ensure an agricultural system (supported by its surrounding environs) that maintains high productivity in the face of climate change; analyze and identify climate change mitigation strategies and technologies to address greenhouse gas emissions and

other climate-altering factors and activities related to agricultural lands and urban environments; address the effect of climate change on water resources and aquatic and terrestrial life.

Extension and outreach will focus on the establishment of expedient response groups/other means of information sharingstructured to provide information to Michigan food producers on critical information related to production at crucial times that will include for example, in-season training and meetings, timely fruit pest monitoring and reporting, updates on control measures, prediction models, weather reports to assist Michigan fruit growers to produce high-quality and profitable crops.

2. Brief description of the target audience

Target audiences include agricultural producers, natural resource managers, environmental organizations, commodity groups and industry representatives, elected officials and policymakers at all levels, and the interested public.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2013

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	17	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research programs on climate change.

Year	Actual
2013	0

Output #2

Output Measure

- Number of producers trained in responding to food production issues resulting in less production and marketing losses

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of research programs to help ensure an agriculture system(and its surrounding environs) that maintains high productivity in the face of climate change.
2	Number of research programs to analyze and identify climate change mitigation strategies and technologies to address greenhouse gas emissions and other climate-altering factors and activities related to agricultural lands and urban environments.
3	Number of research programs that address the effect of climate change on water resources and aquatic life.
4	Number of producers that decrease time taken to respond food production issues resulting in less production and marketing losses.

Outcome #1

1. Outcome Measures

Number of research programs to help ensure an agriculture system(and its surrounding environs) that maintains high productivity in the face of climate change.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Number of research programs to analyze and identify climate change mitigation strategies and technologies to address greenhouse gas emissions and other climate-altering factors and activities related to agricultural lands and urban environments.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #3

1. Outcome Measures

Number of research programs that address the effect of climate change on water resources and aquatic life.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #4

1. Outcome Measures

Number of producers that decrease time taken to respond food production issues resulting in less production and marketing losses.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Sustainable Energy

☐ Reporting on this Program

Reason for not reporting

Went back to original six state plans and incorporated old NIFA Priorities back into these main areas.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	3.2	0.0	3.0	0.0
Actual Paid Professional	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities for this planned program include: developing linkages to connect Michigan industries with the research, education and entrepreneurial activity needed in the basic sciences, engineering, plant science and production agriculture to provide Michigan with a foundation for the

vigorous development of a new biobased economic sector; developing biomass for use for biofuels; developing new biofuel compounds, designing optimum forestry and crops for bioenergy production, developing management practices for bioenergy feedstock production systems; and producing value-added biobased industrial and chemical products.

Extension activities will engage agriculture more fully in development of bioproducts and bioenergy sources that include:

- Development of new bioproducts and markets for bioproducts
- Increased adoption of bioenergy technologies
- Improvement of technology at the farm scale
- Policy development and comprehension

2. Brief description of the target audience

Agriculture and natural resources industry representatives, commodity groups, biofuel/bioenergy producers, biotechnology company representatives, state agencies, elected state and federal officials and other policymakers, entrepreneurs and the interested public.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2013

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	18	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research programs in sustainable energy.

Year	Actual
2013	0

Output #2

Output Measure

- Number of adults trained in sustainable bioenergy crop production.

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of research programs to identify and isolate novel genes, markers, mechanisms and identify genetic pathways that can be used in the development and production of biofuels and other biobased materials and products.
2	Number of research programs to examine and improve efficiencies in bioenergy feedstock production and processing systems.
3	Number of research programs that investigate and/or evaluate the economics of a biobased economy and/or corporate environmental management.
4	Number of participants that increased in their understanding of sustainable bioenergy crop production.

Outcome #1

1. Outcome Measures

Number of research programs to identify and isolate novel genes, markers, mechanisms and identify genetic pathways that can be used in the development and production of biofuels and other biobased materials and products.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Number of research programs to examine and improve efficiencies in bioenergy feedstock production and processing systems.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #3

1. Outcome Measures

Number of research programs that investigate and/or evaluate the economics of a biobased economy and/or corporate environmental management.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #4

1. Outcome Measures

Number of participants that increased in their understanding of sustainable bioenergy crop production.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Childhood Obesity

☐ Reporting on this Program

Reason for not reporting

Went back to original six state plans and incorporated old NIFA Priorities back into these main areas.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	11.4	0.0	1.5	0.0
Actual Paid Professional	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities for this program include:

- Dissemination of science-based information to individuals and families so that they can make

informed decisions about their health and well-being, especially related to obesity and overweight.

• Identification and documentation of environmental and cultural influences on health behaviors contributing to obesity and overweight in children that can be shared with individuals, families and communities to improve health and well-being.

• Development of effective community-based environmental and policy supports for physical activity and healthy eating.

MSU Extension has a long history of collaborations and partnerships through out Michigan and the United States of America, at the national, state, county and local level. In particular, MSUE Nutrition and Physical Activity work team will continue to partner with other states such as Colorado, national associations such as SNE and ASNNA, as well as WIC - Michigan Department of Community Health, the Department of Human Services, Michigan's Food Assistance Program, Michigan Department of Education, Public and Private Schools, Head Start programs, other youth education sites such as YMCA/YWCA, boys and girls clubs, 4-H, parks and recreation site, community fairs, farmers markets, work sites, State Dietetic Association, MiSNAC, community coalitions, medical centers and physicians serving people with limited incomes, community centers, community action agencies, homeless shelters, domestic violence shelters, child abuse prevention programs, libraries, public housing sites, churches, adult rehabilitation centers, food stores, food pantries, and food banks. From these agencies and at these venues, trainings will focus on healthy eating (portions and type of food), physical excercise and social/emotional well-being.

2. Brief description of the target audience

State and community agencies, schools and organizations that deal with healthy eating and physical activity as a pathway to wellness; pediatric caregivers; individual consumers, particularly mothers; food marketers/retailers (especially those targeting children), producers and processors; and other researchers and institutions conducting childhood obesity research.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2013

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	6	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research programs in childhood obesity.

Year	Actual
2013	0

Output #2

Output Measure

- The number of adults trained in controlling food portions.

Year	Actual
2013	0

Output #3

Output Measure

- The number of youth trained in controlling food portions.

Year	Actual
2013	0

Output #4

Output Measure

- The number of youth trained in healthy physical activities.

Year	Actual
2013	0

Output #5

Output Measure

- Number of youth trained in various positive coping skills.

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of research programs that address obesity and diet quality and dietary attitudes and behavior of children and youth.
2	Number of research programs that address school and community-based supports for physical activity and healthy eating, with a focus on children and youth.
3	Number of research programs that address the association between diet, obesity and disease.
4	Number of adults that increase their knowledge about controlling their food portions that align with the food guidedlines.
5	Number of youth that increase their knowledge about controlling food portions according to the food guidelines.
6	Number of youth that increase their physical activities.
7	Number of youth that increase their positive coping skills.

Outcome #1

1. Outcome Measures

Number of research programs that address obesity and diet quality and dietary attitudes and behavior of children and youth.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Number of research programs that address school and community-based supports for physical activity and healthy eating, with a focus on children and youth.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #3

1. Outcome Measures

Number of research programs that address the association between diet, obesity and disease.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #4

1. Outcome Measures

Number of adults that increase their knowledge about controlling their food portions that align with the food guidedlines.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #5

1. Outcome Measures

Number of youth that increase their knowledge about controlling food portions according to the food guidelines.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area

{No Data}	null

Outcome #6

1. Outcome Measures

Number of youth that increase their physical activities.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #7

1. Outcome Measures

Number of youth that increase their positive coping skills.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 11

1. Name of the Planned Program

Food Safety

☐ Reporting on this Program

Reason for not reporting

Went back to original six state plans and incorporated old NIFA Priorities back into these main areas.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	6.9	0.0	5.5	0.0
Actual Paid Professional	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research activities in this planned program seek to to: ensure the microbial safety of foods; develop effective biosensors, RFID tags and other technologies for track, trace and security issues; develop sustainable packaging systems to enhance food quality and shelf life; enhance the economic and

nutritional value of food products through post-harvest and food processing technologies; identify and control/eliminate the causes of microbial resistance to contaminants; and improve the diagnosis and prevention of known and emerging infectious diseases of livestock and poultry.

MSU Extension will focus it's activities in this area on helping producers improve the quality of food delivered to markets and address food safety issues, education will be provided to food handlers in restaurants on food safety issues, training the public on cooking temperatures and storage, and training to youth regarding hygiene.

2. Brief description of the target audience

Food safety professionals, consumers, public health and other state agency representatives,commodity groups, agricultural producers (crop and livestock), food chain supply industry representatives, retail food stores, restaurants, farmers markets.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2013

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	29	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research programs in food safety.

Year	Actual
2013	0

Output #2

Output Measure

- Number of producers that are trained on food safety issues.

Year	Actual
2013	0

Output #3

Output Measure

- Number of producers trained on federal and state legislation regarding food safety.

Year	Actual
2013	0

Output #4

Output Measure

- Number of front-line food handler staff trained on how to that reduce cross contamination.

Year	Actual
2013	0

Output #5

Output Measure

- Number of front-line food handler staff trained in proper cooking and storing temperatures.

Year	Actual
2013	0

Output #6

Output Measure

- Number of youth trained on hand washing practices.

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	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, such as E. coli, Salmonella, Listeria, Campylobacter, etc.
2	Number of research programs to improve the microbial safety and quality of food.
3	Number of research programs to develop packaging systems that enhance food safety, quality and shelf life.
4	Number of research programs to reduce economic losses and food safety risks associated with livestock and poultry diseases.
5	Number of programs to improve harvest, post-harvest and processing technologies related to food safety and product quality.
6	Number of research programs to examine the function and effect of dietary nutrients on immune response and other metabolic functions.
7	Number of producers that become more knowledgeable about food safety issues by participating in GAP audits and other food safety programs.
8	Number of producers that gain knowledge about federal and state legislation regarding food safety.
9	Number of front-line food handler staff and fellow workers that improve in cross contamination.
10	Number of youth that improve on hand washing practices.

Outcome #1

1. Outcome Measures

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, such as E. coli, Salmonella, Listeria, Campylobacter, etc.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Number of research programs to improve the microbial safety and quality of food.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #3

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual

2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #4

1. Outcome Measures

Number of research programs to reduce economic losses and food safety risks associated with livestock and poultry diseases.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done

{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #5

1. Outcome Measures

Number of programs to improve harvest, post-harvest and processing technologies related to food safety and product quality.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #6

1. Outcome Measures

Number of research programs to examine the function and effect of dietary nutrients on immune response and other metabolic functions.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #7

1. Outcome Measures

Number of producers that become more knowledgeable about food safety issues by participating in GAP audits and other food safety programs.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #8

1. Outcome Measures

Number of producers that gain knowledge about federal and state legislation regarding food safety.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #9

1. Outcome Measures

Number of front-line food handler staff and fellow workers that improve in cross contamination.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #10

1. Outcome Measures

Number of youth that improve on hand washing practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}