

2008 Michigan State University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Michigan State University (MSU), the state's land grant institution, is charged with generating research-based knowledge and educational programs people can access to make informed decisions to improve their lives.

The mission of the Michigan Agricultural Experiment Station (MAES) is to engage in innovative, leading-edge research that ensures the wise use of agricultural, natural and community resources and enhances the quality of life in Michigan, the nation and the world. The MAES strives to maintain a balance between basic and applied research and relies heavily on the input of its constituents in identifying research priorities. The accomplishments and discoveries outlined in this report are reflective of the reason why MAES continues to be one of the most successful agricultural experiment stations in the country.

Michigan State University Extension (MSU Extension) helps people improve their lives through an educational process that applies knowledge to critical issues, needs and opportunities. One of the hallmarks of MSU Extension is its willingness and ability to adapt its programming to meet the current needs of Michigan residents, communities and businesses.

The success and accomplishments of the MAES and MSU Extension are fueled by close ties with each other as well as linkages to state agencies, commodity groups and other stakeholders, and outstanding legislative support.

It is important to note that this report reflects only a portion of MAES and MSUE and not the whole breadth of research and educational initiatives. MAES total budget for 2008 was \$110.5 million with this report representing \$5 million in federal Hatch dollars and equivalent match. MSUE's total funding in 2008 was over \$88 million with this report representing approximately \$8 million federal formal dollars and equivalent match.

MAES/Research 2008 Quick Facts:

137 Hatch-funded researchers representing 87 FTEs

245 active projects

25 patents awarded

21 patent applications submitted

255 peer-reviewed publications

Key research accomplishments for FY 2008 include:

Creating Healthy Communities - Michigan was recently ranked as the ninth heaviest state in the nation. MAES researchers collaborated with state and community partners to help improve the state's Promoting Active Communities (PAC) Program, a Web-based assessment and award system. Since 1981, 88 communities from 43 counties have completed the PAC assessment at least once and 30 communities have earned more than one award.

Taking Aim at Wheat Disease - In the past 15 years, Fusarium Head Blight has emerged as a significant threat to the long-term viability of the wheat industry worldwide. Researchers have identified the genome sequence of this disease and are now working to develop new control approaches to safeguard the industry.

Forecasting the Fight Against Famine - The devastating plant disease that triggered the Irish potato famine in the 19th century is being battled today by growers using 21st century technology. The MSU Web site – www.lateblight.org – helps farmers monitor their crops' risk of developing late blight, an infection that destroys 15 percent of the worldwide potato crop each year. In 2007, more than 1,000 Michiganders visited the site.

Going Native to Protect Blueberries – Michigan is the country's top producer of blueberries, with more than 500 growers harvesting berries valued at \$100 million on 20,000 acres. To ensure maximum pollination, MAES researchers have identified more than 170 species of native bees and are putting nesting boxes and native plants in fields to attract and keep bees where they're needed.

Finding Nemo: Climate Change and the Great Lakes - To adapt successfully to changes in Michigan's climate, it is critical to understand the response of the Great Lakes water budget to common global warming scenarios. MAES researchers have developed a climate model to more accurately project water budget changes specific to the Great Lakes region.

Controlling Sea Lamprey - Every year, the U.S. and Canadian governments spend about \$10 million to \$15 million on sea lamprey control, mainly relying on TFN, a larvae-killing compound that's dumped into freshwater streams where lampreys spawn. MAES researchers have identified the chemical that lampreys use to lure females and have developed a synthetic version that effectively controls the sea lamprey while maintaining a healthy Great Lakes ecosystem.

Rising from the Ashes – Since it was identified in Detroit in 2002, the Emerald Ash Borer has killed about 30 million ash trees in southeastern Michigan and has cost municipalities, property owners, nursery operators and forest product industries tens of millions of dollars. Researchers have recently discovered that emamectin benzoate is remarkably effective in controlling EAB – it killed adult beetles and reduced the number of larvae by 99 percent compared to untreated trees. The Michigan Department of Agriculture approved a special registration to begin using it to control EAB.

Making the Mark with a New Black Bean Variety - A new black bean variety, aptly named Zorro, is available for bean growers nationwide to plant in 2009. The high-yielding bean's upright growth makes it easy to harvest directly. Zorro also has excellent processing quality. Along with Zorro, two additional bean varieties will be released this year – Sante Fe, a pinto that has tolerance to white mold, an upright architecture and excellent yield; and Fuji, a tebo bean variety with resistance to viral diseases.

Foraging Ahead in Dairy Cow Nutrition – Finding the right balance between forages and concentrates (e.g., corn and soybean meal) in dairy cow diets is essential to sustain the milk yield and profitability of dairy operations and ensure animal health. Tools such as Corn Picker for Silage (www.msu.edu/~mdr/cornpicker1.05.xls); and Michigan Corn Hybrids Compared (www.css.msu.edu/varietytrials/corn/Corntrials.htm) were developed to more precisely determine ration balancing and its effect on the input-output process to optimize profit.

Revolutionizing the Michigan Juice Grape Industry - Advances in vineyard mechanization technology mean a job that previously took up to 40 hours per acre can now be completed in one-fourth of the time, lowering the costly expense of hand pruning and improving grower profitability. Twenty years ago, Michigan's vast juice grape vineyards were all pruned by hand. Today, more than half are mechanically pruned.

Designing Biosensors for Safety and Security – Researchers have developed various biosensor designs that will quickly detect -- in less than an hour -- high priority select agents of concern to homeland security and the healthcare field. Patenting and licensing of the devices is underway and interest in commercializing the devices is increasing.

Developing Environmentally Sustainable Plastics – Each year, plastic mulch covers 30 million acres of cropland worldwide. Getting rid of the used plastic is a big annual expense for growers and adds nearly 2 million pounds of waste plastic to landfills. MAES scientists have developed a plastic film that degrades and integrates into the soil. Once commercialized, the film could save growers about \$100 per acre and reduce pesticide and herbicide use.

Breathing Easier - According to the Asthma Initiative in Michigan, 233,894 children under the age of 18 have asthma in Michigan. And approximately 9 percent of Michigan's adult population has asthma -- 1 percent higher than the national average. An MAES researcher is studying chronic respiratory diseases caused by air pollutants to better understand how nasal tissues and cells may respond to inhaled toxicants. The results will be used to better protect the public, especially children and other susceptible individuals – asthmatics and the elderly -- who are most sensitive to the damaging effects of air pollution.

Saving Money with Renewable Fuels - A patented Michigan State University process to pretreat crop waste before its conversion into ethanol means extra nutrients don't have to be added and so cuts the costs of making biofuels from cellulose. The AFEX (ammonia fiber expansion) pretreatment process, developed by Bruce Dale, MAES chemical engineering and materials science researcher, uses ammonia to make the breakdown of cellulose and hemicellulose in plants 75 percent more efficient than when conventional enzymes alone are used.

Experimenting with Wiki - MAES information and technology researcher Cliff Lampe is experimenting in electronic environmental reporting to help rural communities keep pace with the ever-increasing digital exchange of information through the use of a 'wiki' – a new form of electronic citizen journalism (<http://greatlakeswiki.org>). Launched in 2006, the hope is that persons living in the less densely-populated Upper Peninsula and northern Lower Peninsula will eventually blog about the lakes as enthusiastically as those living in more densely populated parts of the state.

MSU Extension 2008 Quick Facts:

262 educators/specialists representing 171 FTEs of MSUE's total FTEs of 721 were funded by federal formula funds or match

180,697 adults were educated with approximately 25% represented in this report

236,435 youth were educated with approximately 25% represented in this report

Key educational accomplishments for FY 2008 include:

- In Oakland County, home to 6,900 of the state's 115,500 equines, MSU Extension has helped horse lovers band together to recycle the manure-encrusted wood chips they use for bedding into electricity. To date, Flint-based Mid-Michigan Recycling has collected more than 20,000 tons of bedding to produce electricity for more than 28,000 southeastern Michigan homes.
- MSU Extension sponsored a bioenergy bus tour to Iowa in August 2008. Twenty-five participants, including farmers, the Michigan departments of agriculture and environmental quality, USDA Rural Development, Extension, several resource conservation and development programs and local conservation districts visited several public and private projects to learn about bioenergy. The primary purpose of the trip was to provide an in-depth, first-hand look at a variety of bioenergy topics, including ethanol and biodiesel production, wind energy, sustainability of new energy crops, cellulosic conversion technologies, methane digestion and rural economic development. Following its completion, participants reported an average increase in their knowledge of bioenergy topics of about 70 percent.
- More than 10,000 acres of Michigan land are defined as brownfields, but new research shows the potential these polluted sites offer to Michigan's growing bioeconomy. Researcher Kurt Thelen recently concluded that while food can't be grown on brownfields, bioenergy crops grow productively and do not transfer contaminants to the crop or the fuel, making them a prime location for switchgrass, canola and other non-consumable plants. The Land Policy Institute, a MAES and MSUE supported program, released a 2009 study that estimates the renewable energy potential of brownfield sites in Michigan could power almost half of Michigan homes (1.8 million) and stimulate the creation of more than 17,500 jobs and \$15 billion in new investments.
- In early 2008, MSU Extension partnered with the MSU Product Center and the Kellogg Biological Station to help advance development of the bioeconomy. We have re-tooled the positions of two educators to ensure we are helping Michigan residents prepare for the expanding bioeconomy. Our new bioeconomy innovations counselor is charged with helping develop businesses that will help replace or reformulate current petroleum-based products, including ethanol, biodiesel, plastics, textiles, nutraceuticals and pharmaceuticals. In addition, we now have a biofuels educator who field-tests new crops, carries new information and technologies to the farm level, and helps inform the public about energy use and opportunities for the bioeconomy. . (NOTE INTEGRATED)
- Since 2000, the MSU Small Town and Community Design Initiatives (STDI/CDI) have completed or are currently working on 57 projects, in 69 communities, across 31 Michigan counties. In each case, MSUE, has been an integral and significant partner. Projects have included downtown revitalization, streetscapes, park design, county fairgrounds master plans, community image develop, beautification, waterfront development, neighborhood renewal, transportation systems and community branding. In almost all cases, there has been a direct relationship to community economic development. Communities have used the STDI/CDI documents to work with their consultants, local and regional planning agencies, downtown development authorities, volunteer groups, and state agencies such as MDOT. Communities have also applied for and received grants totaling about \$4 million to make improvements recommended by the STDI/CDI.
- Project FRESH gave 435 Ottawa County senior citizens \$25,900 worth of Project FRESH coupons, which they used to support the local economy by redeeming them at local farm markets. In sparsely populated Ontonagon County, local gardeners earned \$2,800 when MSU Extension established the county's first farmers' market; low-income seniors purchased \$1,200 of locally grown vegetables through Project FRESH. In Wayne County alone, local farmers received nearly \$25,000 through Project FRESH, as families in the W.I.C. program redeemed coupons for locally grown fruits and vegetables, improving their nutrition and overall health. In 2007, approximately 44,000 WIC clients and low-income seniors received coupons through the Project FRESH and Senior Project FRESH programs. They redeemed those coupons at farm markets to purchase fresh, locally grown produce, pumping \$656,072 into the hands of Michigan farmers while simultaneously improving their nutrition by eating more fruits and vegetables.
- 4-H started 12 Future Entrepreneurs clubs in eight counties in 2008. Club participants learn to create business and marketing plans, develop products, set pricing, create packaging and actually sell their products for a profit. 4-H is training Michigan's future small business owners. Fifteen 4-H youth who raised animals for market sale in Ontonagon County earned over \$10,000 in profits, which they use toward raising more market animals, money for college, and money to put back into Michigan's economy. In Iosco County alone, two 4-H programs have brought \$55,000 into the county. The 4-H Peer Mentoring Learn and Serve program received a \$25,000 grant and created one new job; the 4-H Market Livestock Sale generated \$30,000 for participating youth, money that goes back into the local and state economy. Every county in the state has similar (and often larger) outcomes.
- Tribal leaders from 11 of the 12 federally recognized tribes in Michigan attended the first Building Strong Sovereign Nations (BSSN) Conference, Feb. 4-5, 2009 near Traverse City. The first tribal governance training of its kind that was held on Indian land in conjunction with a university, the program drew about 50 people, including a representative from the National Congress of American Indians. The conference provided training on strengthening tribal governance and access to resources available to tribal leaders through MSU Extension, the MSU Native American Institute and the MSU Indigenous Law and Policy

Center.

- The MSU Extension community and economic development educator worked with 12 community organizations in the Genesee County Land Bank's Clean and Green Program and assisted in revising the program's planning, implementation and evaluation processes. The Clean and Green Program participants maintain about 600 vacant properties; the Land Bank currently has more than 2,000 vacant properties.
- Of the 537 Macomb County residents who attended MSU Extension sponsored foreclosure prevention or counseling seminars in 2008, 148 were able to avoid foreclosure, which saved \$3.2 million to the homeowners, neighbors and local government.
- During the 2008 programming year, Washtenaw MSUE provided business-planning services to 102 clients. Thirty-three of these clients launched new ventures or expanded existing businesses. Estimated gross revenue of business planning clients is \$1,084,000. It is estimated that 115 jobs were created or retained as a result of this work.
- Members of the MSU Extension Farm Management Team met with managers of 254 farm operations during 2007 to help them complete farm business analyses. During the analyses the farm owners generated end-of-year net worth statements and accrual adjusted income statements and learned about many other important financial data pieces and trend information. The total net worth of these farms was \$676,150,000 or \$2.6 million per farm. The MSU Extension Farm Management Team offers farmers instruction in estate planning and business succession. Team members worked with 253 family members who manage 67 farm businesses during 2007. Those businesses controlled 84,170 acres of land, and by implementing the suggestions team members offered, they will save more than \$25,683,000 or \$383,000 per farm in future estate taxes.
- The MSU Extension Farm Management Team offers income tax planning education to Michigan farmers. In 2007, family members representing more than 172 operations requested assistants. These growers were able to delay \$3,886,000-\$22,500 per farm—in federal and state income and self-employment taxes.
- Many MAES projects and partnerships have a goal of making Michigan agricultural and natural resources industries more profitable. To ensure that these sectors continue to receive critical competitiveness data, the MAES and MSU Extension signed a cooperative agreement with the Michigan Department of Agriculture and the U.S. Department of Agriculture to fund the state statistician position within the Michigan field office. Collaborative relationships resulted in services being continued by leveraging resources.
- Washtenaw County has more than 1,000 farm businesses. Of the 150 farms that provide primary income for local farm owners, 80 percent of full time farmers report using MSUE on-farm research and other MSU educational information to adjust production systems. Farmers utilizing MSUE research information report improving farm net income by \$17 per acre. Local farm businesses have realized an annual benefit from MSUE research and information of more than \$2.4 million.
- More than 360,000 of Michigan's most vulnerable citizens received education on how to eat healthier and spend their food dollars more wisely through Supplemental Nutrition Assistance Program Education provided by MSU Extension in all 83 Michigan counties.
- More than 460 participants in the Breastfeeding Initiative (BFI) exclusively breastfed their infants for at least six months, saving the state an estimated \$335,000 in WIC costs and Medicaid expenditures in FY 2008 as well as reducing the possibility of childhood obesity among these infants. Pre- and post-program evaluations show that MSUE's youth nutrition programs in 2008 caused significant increases healthy behaviors, including hand-washing, choosing healthy snacks, being physically active every day and eating vegetables every day.
- MSUE's Youth Farm Stand projects resulted in a 70 percent increase in children eating fruits and vegetables and a 62 percent increase in children choosing healthier snacks. These outcomes directly address Michigan's crisis-level youth obesity issue.
- In 2007, Michigan 4-H Youth Development helped nearly 90,000 youth improve their knowledge of health-related issues such as nutrition, physical fitness, tobacco use, food safety and personal safety.
- MSUE is Washtenaw County's only provider of pre-purchase homebuyer education, which has been shown to be the most effective foreclosure prevention intervention. During 2008, MSUE housing counselors met with 160 clients and helped 47 of them avoid foreclosure. These efforts saved \$9.2 million worth of primary residencies and retained an estimated \$200,000 in tax revenues.

- Several counties offered hundreds of free classes and individual counseling sessions on bankruptcy, foreclosure prevention, mortgage management, family budgeting and several other topics related to family financial management. Based on the charges other agencies typically charge for such services, MSUE saved Michigan families nearly \$61,000.
- Michigan's childcare providers are required to receive training each year to maintain their licenses. Most agencies provide this training at approximately \$10 per hour per participant. MSUE's Better Kid Care training is free, saving its 15,886 participants \$417,000 in 2008 for 41,700 hours of training. Nearly 16,000 childcare providers would not have received the training they need without MSU Extension's Better Kid Care program.
- In St. Clair County, 49 families with a total of 70 children received in-home parenting education through MSUE. Many were referred from DHS, Head Start, county hospitals and other agencies dealing with at-risk families. Extensive research has shown that in-home parenting education results in a 78 percent decline in verified reports of child abuse, 30 fewer months on welfare and a 56 percent decline in arrests of the children as they grow older. (Pennsylvania Partnership for Children, 2002)
- The 20,000 Michigan youth in foster care cost the state more than \$123 million. MSUE's in-home parenting education programs not only help keep kids from entering the foster care system, they also teach parents anger management, how to use discipline, home safety and how to ask for help.
- The MSU Beef Team and the College of Veterinary Medicine conducted bull breeding soundness examinations (BSE) in early 2008 on 272 bulls owned by 86 Michigan cattle producers. Of these bulls, 74 percent were judged to be satisfactory potential breeders, while 19 percent faced deferred judgment and 7 percent failed the exam because of major problems. Using these failed bulls in their breeding operations could have potentially cost producers \$120,500.
- MSU Research and Extension support led to the formation of the Michigan Turkey Producers Cooperative, helping to salvage Michigan's turkey industry 10 years ago when the state's major live turkey processor, Sara Lee, announced that it would no longer process live birds from Michigan growers. The cooperative has evolved from a single product line—selling live turkeys – to selling a wide array of turkey-based products. Buyers include companies such as Sysco, Gordon Foods and Superior Seafoods. Their cooperative created 550 jobs in their two Wyoming, Mich.-based plants, and the growers who were able to save their farms employ a total of more than 200 family members, service workers and farm managers.
- Fertilizer costs are projected at more than 50 percent of cash costs at planting time for corn and 25 percent of the total direct costs of corn production for the entire season. Fertilizer prices have quadrupled since 2002 and peaked in 2008. Over the same time period commodity prices also hit record high peaks but have now fallen disproportionately lower than fertilizer prices. To help farmers get the greatest return on their investments, the MSU Extension Field Crop Team developed a new comprehensive fertilizer planning guide, published in February 2009. This promotes the new Economic Optimum Nitrogen Rate, which is also available electronically at a regional Web site that estimates the N rate for corn based on fertilizer prices and expected price per bushel.
- The soybean aphid is the most important insect pest of soybean in the North Central U.S. Outbreaks cost farmers millions of dollars per year in lost yield and increased costs of control. The insecticides used to control soybean aphid can have non-target effects on pollinating insects. MAES researchers discovered that naturally occurring predators slow or prevent soybean aphid outbreaks, saving Michigan farmers \$24-138 million per year in averted yield losses and pesticide application costs. Reducing the need for pesticides has the additional benefit of improving the environment for pollinators and other wildlife. The findings suggest further savings can be realized by improved management of crop and non-crop habitats increasing the sustainability of rural landscapes.
- More than 5,000 samples were processed in 2008 by MSU Diagnostic Services, which specializes in diagnosing disease, weed, insect and nematode issues for the agriculture community and home gardeners.
- Corn and Soybean prices have declined sharply and are projected to remain near or below the cost of production in 2009. MSUE and the Michigan corn and soybean checkoff programs sponsored four Corn and Soybean Research and Pest Management Updates in early 2009 for nearly 300 farmers and agribusiness representatives. An evaluation of participants at three of the locations showed that 73 percent plan to use what they learned to make management decisions or implement new practices in 2009 and 61 percent expect that what they learned will help them earn or save them money in 2009. The average amount of money they plan to earn or save is \$7.60 per acre. Since the participants plan to apply their new knowledge and practices to 45,055 acres, the projected financial impact of this educational program will be more than \$342,000 in 2009.
- In 2008 Michigan's blueberry crop hit a record, leapfrogging from 62 million pounds in 2003 to 110 million pounds in 2008. Per acre blueberry yields increased from 3,900 pounds in 2003 to 5,950 pounds in 2008. The MSU Extension Fruit Team and Ottawa County Extension Small Fruit Education program have played an important role in this success. The MSUE Small

Fruit program has contributed to elevate the level of technical knowledge among blueberry growers and farm laborers by bringing educational programs and technical assistance to help this community to overcome environmental, regulatory and market challenges.

- More than 16,000 users review weekly research and Extension information publicized through MSU Integrated Pest Management (IPM) program's Crop Advisory Team Alerts. IPM promotes applied research and Extension to guide growers in making responsible pesticide decisions, such as a codling moth project that has decreased the overall amount of pesticides applied to Michigan apples by almost 6,000 pounds a year.

- Ten years ago, the Michigan sugarbeet industry was dying, with declining yields and global competition closing in on more than 1,000 Michigan sugarbeet growers. Now, Michigan sugar producers have increased their yield 30 percent, a trend they attribute to the research and education partnership between the MAES, MSUE, the Michigan Sugar Company and the Sugarbeet Advancement Program, an industry organization.

- More than 1,200 Michigan residents enrolled in Master Gardener volunteer training programs in 2008, joining more than 6,900 existing volunteers. More than 3,300 of these volunteers across Michigan performed nearly 197,000 volunteer hours for their communities that were valued at \$3,842,631.07.

- In 2007 the MSU Extension Forestry Team conducted a series of information sessions to alert landowners to the opportunity to enroll in the newly established Qualified Forest Program. Nearly 175 participants took part in the program, representing more than 2,500 acres.

- Michigan's 4-H Great Lakes and Natural Resources Camp has given more than 1,000 participants a greater appreciation of the outdoors and greater understanding of natural resource ecology and management, as well creating the next generation of natural resource stewards. The program was recently named the top conservation/environmental 4-H Program of Distinction in the country and earned a \$10,000 prize.

Total Actual Amount of professional FTEs/SYs for this State

Year:2008	Extension		Research	
	1862	1890	1862	1890
Plan	180.0	0.0	85.0	0.0
Actual	171.5	0.0	87.0	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
- Combined External and Internal University Panel
- Combined External and Internal University External Non-University Panel
- Expert Peer Review

2. Brief Explanation

The challenges facing Michigan agriculture and natural resources are increasingly complex and diverse. MAES research programs are continuously evaluated for relevance and progress. A strategic visioning process, linked to those of MAES-affiliated colleges at MSU -- Agriculture and Natural Resources, Communication Arts and Sciences, Engineering, Natural and Social Sciences, and Veterinary Medicine -- identified five strategic priority areas in 2006 that will drive the MAES research agenda over the next decade. This process also involves industry experts, university faculty members, MSU Extension and MAES Council members, and includes scientific review by peers (local, national and international). These target areas address the research priorities of Michigan agriculture and natural resources industries, but are also linked to national and global goals and new initiatives. The target areas are: Food and Health, Environmental Stewardship and Natural Resources Policy and Management, Enhancing Profitability in Agriculture and Natural Resources, Secure Food and Fiber Systems, and Families and Community Vitality.

MSU Extension uses several continuous processes that assist in setting priorities and evaluating program goals and plans. At the county level, the public, local government officials, advisory group members, Extension and council members, staff members and industry experts are involved in both the stakeholder process and review of the county and individual agents' plans. Each Area of Expertise (AoE) team reviews the county needs, agents' plans and research to support these programs as well as others that reflect emerging trends. In addition, the AoE goals are reviewed by state leaders and industry experts for quality and relevance. Collectively, these plans are reviewed by MSU Extension and MAES directors who not only evaluate them, but use them in their regional and statewide presentations to describe future plans.

Jointly, the MAES and MSU Extension address issues of concern in local communities with research and teaching by using a network of citizen advisory groups at the local and state levels. County Extension councils identify and prioritize issues, seek collaborations and resource, and communicate to others the importance of MSU Extension educational programming. Citizen Advisory Councils help establish research priorities at the 15 MAES field research stations. The MSU Extension and MAES Council serves as a liaison among county councils, field station 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

Brief Explanation

During 2005-2006, The Michigan Agricultural Experiment Station (MAES) and Michigan State University Extension (MSUE) completed a comprehensive statewide process – Strengthening Michigan's Economy: Roles for MAES and MSUE. Nearly 10,000 people took part in this issues identification process to help define future research and educational priorities for the two organizations. The five strategic priorities that emerged were: developing entrepreneurs, promoting healthy lifestyles, preparing for the expanding economy, educating and supporting decision makers, and building leaders for today and tomorrow.

In 2008, a variety of activities added to the leveraging of this process. The five strategic priorities continued to be discussed with the joint MAES/MSUE state council at its spring and fall meetings.

The entire 2008 MSUE Fall conference was organized around the five priority areas. On opening night, members of an expert panel detailed how their organizations have worked to develop the five priority areas identified in the Strengthening Michigan's Economy process in urban neighborhoods, as well as how Extension staff members might be able to identify needs and develop methods to carry these concepts and efforts out to communities. During the conference, off-site workshops with targeted site visits based on each priority area were held, as well as concurrent priority area-based research sessions so attendees could participate in sessions for at least two of the priority areas. The research sessions were: Promoting Healthy Lifestyles – "The Housing Crisis: History, Policy and Problem Solving," "Building Leaders for Today and Tomorrow – Connecting with Fathers for Better Child Outcomes," Preparing for the Bioeconomy – "Michigan's Bioeconomy Future," Developing Entrepreneurs – "Women and Minority Businesses," and Educating and Supporting Decision Makers – "Decision Making Models for Stakeholders."

Progress and revisions based on the five priorities are updated also on a continuous basis at the county level. An aggregate county report for the past year is being prepared and will be presented to the state coalition in Spring 2009. County staff also submits two partner reports a year to highlight partnership efforts. These are used to customize information provided to county commissioners, state legislators or others who use MAES/MSUE information resources.

As mentioned in last year's Plan of Work, MSUE has contracted with the Institute for Public Policy and Social Research (IPPSR) to include questions related to the five priorities on its State of the State Survey (SOSS) for three years (2007 to 2009). In 2008, survey questions were posed related to home foreclosure in Michigan and Michiganders' perspectives on locally-grown food. The results of these surveys are included in the "What you Learned from Your Stakeholders" section of this executive summary. This surveying will be a continuing source of information to help update and refine how critical issues are approached.

The results of Strengthening Michigan's Economy, SOSS survey results and ongoing input from a variety of sources have also helped MAES and MSUE's Area of Expertise (AoE) teams do a better job of reporting what they've done and to inform future programming. As demonstrated above, the five priority areas are being used to better clarify and drive the organizations' programs and resources. This has also translated into asking those seeking internal resources to explain how their proposed project or program fits into one or more of the five priority areas. For 2009, AoEs are being asked to use logic models to report on the impacts of their programs.

In 2008, MSUE initiated a major restructure with the establishment of a new unit that combines its 4-H Youth and Family and Child Sciences programs. The major aim of the restructure is to better equip MSUE to determine how its education programs interact with citizens throughout their lifespan. This more consolidated approach is organized around the priority areas within the broad unit of children, youth, families and communities.

In a related initiative, MSU secured \$57 million in funding in October 2008 from the National Institutes of Health to expand its role in the largest research project ever to study children's health and the causes of ailments such as autism, cerebral palsy and asthma. By studying children's environment, By following children from before birth and studying their environment, researchers and health care professionals will be able to seek out ways to prevent many of the diseases children now suffer from. As part of an alliance with Michigan's top research universities, health care systems and state and local health agencies, MSU is leading the state's role in the National Children's study, which will monitor more than 1,000 children. Funding will allow MSU to study children in Genesee, Grand Traverse, Lenawee and Macomb counties. That money is in addition to the \$18.5 million announced last fall for study work in WayneCounty. Project collaborators include MSU (including MSUE and MAES), University of Michigan, Henry Ford Health System, Michigan Department of Community Health, and health departments in each of the five participating counties.

Plans are underway to conduct another Stengthening Michigan's Economy survey in 2010.

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

The Strengthening Michigan's Economy process and ongoing efforts offer multiple ways for people in various roles and locations to help identify the issues and opportunities for MAES research and MSU Extension educational programming during the years ahead.

Statewide telephone surveys for the State of the State Survey (SOSS) and citizen focus groups are used to identify the major issues and opportunities in Michigan and assign a priority ranking to each. The use of SOSS quarterly surveys to gain insight and input into programming is being continued for at least the next two years.

An initial Web-based survey asked what people saw as the role for MAES and MSU Extension related to key issues and opportunities. Similar surveys may be developed and disseminated to seek additional input.

Community-based discussions in all Michigan counties, involving the local MAES advisory committees, MSU Extension councils and others are held to discern what issues and opportunities stakeholders believe should be addressed by MAES research and MSU Extension educational programming.

Area of Expertise (AoE) teams conduct subject-specific focus groups comprising a variety of stakeholders and continue to assess and revise their reporting and work.

Community groups, commodity and producer groups and other state and local partners are periodically asked what specific issues and opportunities should be addressed by MAES research and MSU Extension educational programming.

The MAES/ MSU Extension State Council respond to the question: "Looking at the results of the SOSS survey, what are the implications for MAES and MSU Extension research and educational programming in the future?" as the results of the quarterly surveys are released.

AoE chairs representing 29 teams have identified emerging issues and opportunities. Each team conducts stakeholder/constituent input sessions as needed. This input is reflected the results in their respective plans of work.

Faculty focus groups, with representatives from all MSU colleges and units, are held as needed to glean faculty perceptions of emerging Michigan issues and opportunities and identify ways that MSU science might be used to address those issues and opportunities.

MSU faculty and MAES/MSU Extension staff surveys are used as needed to develop a better understanding of the university's ability to respond to the issues and opportunities identified in the faculty focus groups.

County teams, including MAES field station managers, synthesize and submit local priorities identified by local MSU Extension councils and MAES advisory committees.

AoE teams synthesize and prioritize content-specific program and research needs generated from the input of their advisory bodies and continue to fine tune these needs based on additional input moving forward.

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

In 2008, several methods were used to collect stakeholder input.

The five strategic priorities continued to be discussed with the joint MAES/MSUE state council at its spring and fall meetings to solicit input from state leadership.

The entire 2008 MSUE Fall conference was organized around the five priority areas. On opening night, members of an expert panel detailed how their organizations have worked to develop the five priority areas identified in the Strengthening Michigan's Economy process in urban neighborhoods, as well as how Extension staff members might be able to identify needs and develop methods to carry these concepts and efforts out to communities. During the conference, off-site workshops with targeted site visits based on each priority area were held, as well as concurrent priority area-based research sessions so attendees could participate in sessions for at least two of the priority areas. The research sessions were: Promoting Healthy Lifestyles – "The Housing Crisis: History, Policy and Problem Solving," "Building Leaders for Today and Tomorrow – Connecting with Fathers for Better Child Outcomes," Preparing for the Bioeconomy – "Michigan's Bioeconomy Future," Developing Entrepreneurs – "Women and Minority Businesses," and Educating and Supporting Decision Makers – "Decision Making Models for Stakeholders." As mentioned in last year's Plan of Work, MSUE has contracted with the Institute for Public Policy and Social Research (IPPSR) to include questions related to the five priorities on its State of the State Survey (SOSS) for three years (2007 to 2009). In 2008, survey questions were posed related to home foreclosure in Michigan and Michiganders' perspectives on locally-grown food. The results of these surveys are included in the "What you Learned from Your Stakeholders" section of this executive summary. This surveying will be a continuing source of information to help update and refine how critical issues are approached.

Plans are underway to conduct another Strengthening Michigan's Economy Survey in 2010.

3. A statement of how the input was 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

As discussed earlier, stakeholder input provides the foundation for the research and educational programs developed by the MAES and MSU Extension. Stakeholders help decide the future direction for the MAES through programs such as Project GREEN, the Animal Agriculture Initiative, Families and Communities Together, commodity advisory teams and the Area of Expertise teams. Due to stakeholder input, the MAES has focused more sharply on biobased products that can help boost the Michigan economy including fuels, chemicals, nutraceuticals and food products, the environment, land use issues and biotechnology. Stakeholder input has changed the direction of youth programming to focus on job readiness and health, which have not been traditional program areas. The stakeholder input collected in 2005-2006 and ongoing data collection and input have guided the creation and in-stream modifications documented in the Michigan 2009-2014 Plan of Work for Agricultural Research and Extension Formula Funds for the MAES and MSU Extension.

Brief Explanation of what you learned from your Stakeholders

As mentioned earlier, MSUE contracted with the Institute for Public Policy and Social Research through 2009 to include questions in their quarterly phone surveys related to the five MAES/MSU Extension priorities. In 2008, survey questions were posed related to Michiganders' perspectives on locally-grown food and home foreclosure in Michigan.

Locally-grown food

How important is locally-grown food to Michiganders? And what do Michiganders think of as locally-grown? These were questions answered in part by devoting several questions in MSU's fall 2008 State of the State Survey to the issue of locally-grown food.

Survey result highlights (survey conducted in September 2008): About three quarters (74.8%) of respondents said that they had purchased or were given some locally grown food during the month of September 2008. Of these, 83.2% said that they got their fresh fruits and vegetables from farm stands, roadside stands or CSAs; 65.2 % got them from gardens (their own or others); 54.7% from supermarkets, conveniences stores, grocery stores or food cooperatives; and 53.5% got their fruits and vegetables from farmers' markets. Factors that discouraged people from purchasing locally grown food included cost -- About one quarter (27.8%) of Michiganders perceive the cost of locally-grown foods to be too high; nearly a third of Michiganders (31.8%) perceive that locally grown foods are not readily available to them; a large majority of Michiganders (87.1%) are limited in their purchase of locally-grown foods because they cannot identify them; and over one-third (36.3%) of Michiganders lack at least some food preparation skills needed to purchase and use more locally-grown foods.

Home Foreclosure in Michigan

Home foreclosures are happening in record numbers across Michigan and affect people from all different backgrounds and income groups. In a fall 2008 survey, participants were asked a variety of questions related to foreclosures such as, "In the past two years, have you missed multiple mortgage payments? Did you lose your home to foreclosure? Do you think you will lose your home to foreclosure in the coming year? How many neighbors, friends and families living in Michigan have faced foreclosure in the last two years? Do you think the U.S. housing legislation is good for the state of Michigan?"

Survey result highlights (taken in September 2008): Although only 7.3% of respondents indicated that they had missed multiple payments and/or that their mortgage company had begun foreclosure proceedings, almost a quarter of these respondents (22.5%) lost their homes to foreclosure; 8.2% percent of respondents think they will have difficulty making their house payments and 2.3% think they will lose their home to foreclosure in the coming year; more than half of respondents (53.7%) indicated they had neighbors, friends or family living in Michigan that have faced foreclosure in the past two years or are currently facing foreclosure; and roughly three-quarters think that the U.S. housing legislation is good for the nation as a whole (72.9%) and for the state of Michigan (75.9%).

The questions on these surveys provide baseline data to help understand current situations and determine what actions need to be taken. These and related questions need to be revisited on a regular basis to see how effective actions taken are and to modify them over time. Council members continue to be pleased that MSU Extension and MAES continue to integrate the stakeholder input gleaned from the survey and ongoing feedback and feel that survey data has helped MSU Extension and MAES be more entrepreneurial, more effective in partnering with public and private entities and more congruent in their application of priorities across research and educational programming and funding processes.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
8013752	0	5284677	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	8116300	0	9473239	0
Actual Matching	8116300	0	7964684	0
Actual All Other	0	0	45618857	0
Total Actual Expended	16232600	0	63056780	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous years				
Carryover	5608084	0	4243120	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	Food and Non-Food Quality, Nutrition, Engineering and Processing
5	Economics, Marketing and Policy
6	Animal Production and Protection

Program #1

V(A). Planned Program (Summary)

1. Name of the Planned Program

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

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
702	Requirements and Function of Nutrients and Other Food Components	3%		10%	
703	Nutrition Education and Behavior	5%		7%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.	2%		2%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	5%		5%	
721	Insects and Other Pests Affecting Humans	1%		0%	
723	Hazards to Human Health and Safety	7%		12%	
724	Healthy Lifestyle	11%		20%	
802	Human Development and Family Well-Being	12%		8%	
803	Sociological and Technological Change Affecting Individuals, Families and Communities	3%		6%	
805	Community Institutions, Health, and Social Services	4%		10%	
806	Youth Development	47%		20%	
Total		100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	54.0	0.0	12.0	0.0
Actual	69.6	0.0	11.0	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
2973128	0	1117842	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
2973128	0	939833	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	5383025	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research to:

- Determine the relationship between family lifestyle factors/education and food choices, and general health and well-being.
- Develop improved methods to assess the allergen-causing potential of foods.
- Understand how environmental pollutants, especially ozone and endocrine disruptors, affect human health.
- Increase understanding and develop more effective environmental management systems.
- Develop better models for the human health and human services sectors.

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.
- Improve better tribal governance in Michigan.

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. Tribal members in Michigan.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	3836	7672	4423	6659
2008	6591	13182	7176	14352

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

Patent Applications Submitted

Year	Target
Plan:	0
2008 :	0

Patents listed

Although there were no submissions during this time period, the following three patents were issued:

Chinese Patent No. ZL99816054.7 issued 6/18/2008, titled 'Methods for Inhibiting Cyclooxygenase and Inflammation Using Cherry Bioflavonoids.'

Japanese Patent No. 4100871 issued 3/28/08 titled 'Method and Compositions for Producing Berry-Derived Products.'

Korean Patent No. 0776455 issued 11/7/2007, titled 'Dietary Food Supplement Conatining Natural Cyclooxygenase Inhibitors.'

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan	18	23	
2008	0	30	30

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	Target	Actual
2008	8	30

Output #2**Output Measure**

- Number of adult participants trained in healthy lifestyles.

Year	Target	Actual
2008	1449	1382

Output #3**Output Measure**

- Number of youth participants trained in healthy lifestyles.

Year	Target	Actual
2008	1342	2517

Output #4**Output Measure**

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

Year	Target	Actual
2008	1758	3528

Output #5**Output Measure**

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

Year	Target	Actual
2008	845	2656

Output #6**Output Measure**

- Number of adult participants trained in community institutions, health and social services.

Year	Target	Actual
2008	138	148

Output #7**Output Measure**

- Number of adult participants trained in youth development.

Year	Target	Actual
2008	491	1796

Output #8**Output Measure**

- Number of youth participants trained in youth development.

Year	Target	Actual
2008	2236	2003

Output #9**Output Measure**

- Number of adults trained in topics that support tribal governance.

Year	Target	Actual
2008	30	30

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	Number of research programs to develop an understanding of the function of vitamin A and how it is metabolized in the body.
2	Number of research programs to determine whether and how phytochemicals and probiotic bacteria can reduce the development of cancer cells and chronic diseases.
3	Number of research programs to develop an understanding of how dietary fat affects cell function.
4	Number of research programs to develop an understanding of how zinc affects human immune response.
5	Number of research programs to develop an understanding of how n-3 polyunsaturated fatty acids affect human health and disease, especially cardiovascular disease and inflammation.
6	Number of research programs to develop a stage-based program to increase fruit and vegetable consumption by young adults.
7	Number of research programs to determine the relationship between obesity and family meals/lifestyle factors.
8	Number of research programs to determine the relationship between family lifestyle factors/education and food choices and general health.
9	Number of research programs to determine the relationship between environmental influences and obesity/general health/physical activity.
10	Number of research programs to determine the biological mechanisms that affect the quality and safety of meat food products.
11	Number of research programs to develop improved methods to assess the allergen-causing potential of foods.
12	Number of research programs to develop new techniques that are fast, efficient, easy to use and easy to interpret to detect toxins in foods, especially Listeria, Salmonella, E. coli O157:H7 and Campylobacter.
13	Number of research programs to develop processing techniques to optimize the safety of processed protein-based foods.
14	Number of research programs to develop new methods to reduce the transmission of food-borne pathogens.
15	Number of research programs to develop new methods to control pests in foods that reduce or eliminate chemical residues on food.
16	Number of research programs to understand how environmental pollutants, especially ozone and endocrine disruptors, affect human health.
17	Number of research programs to develop new programs and policies to help young people move successfully from foster care to independent living after they are too old for foster care.
18	Number of research programs to 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.
19	Number of adult participants with increased knowledge about healthy lifestyles.
20	Number of youth participants with increased knowledge about healthy lifestyles.
21	Number of adult participants with increased knowledge of human development and family well-being.
22	Number of youth participants with increased knowledge of human development and family well-being.
23	Number of adult participants with increased knowledge of community insitutions, health and social services.
24	Number of adult participants with increased knowledge of youth development.
25	Number of youth participants with increased knowledge of youth development.
26	Number of native american adults with improved knowledge and skills in tribal governance.
27	Number of research programs to increase understanding and develop more effective environmental management systems.
28	Number of research programs to develop better models for the human health and human services sectors.

Outcome #1

1. Outcome Measures

Number of research programs to develop an understanding of the function of vitamin A and how it is metabolized in the body.
Not reporting on this Outcome for this Annual Report

Outcome #2

1. Outcome Measures

Number of research programs to determine whether and how phytochemicals and probiotic bacteria can reduce the development of cancer cells and chronic diseases.
Not reporting on this Outcome for this Annual Report

Outcome #3

1. Outcome Measures

Number of research programs to develop an understanding of how dietary fat affects cell function.
Not reporting on this Outcome for this Annual Report

Outcome #4

1. Outcome Measures

Number of research programs to develop an understanding of how zinc affects human immune response.
Not reporting on this Outcome for this Annual Report

Outcome #5

1. Outcome Measures

Number of research programs to develop an understanding of how n-3 polyunsaturated fatty acids affect human health and disease, especially cardiovascular disease and inflammation.
Not reporting on this Outcome for this Annual Report

Outcome #6

1. Outcome Measures

Number of research programs to develop a stage-based program to increase fruit and vegetable consumption by young adults.
Not reporting on this Outcome for this Annual Report

Outcome #7

1. Outcome Measures

Number of research programs to determine the relationship between obesity and family meals/lifestyle factors.
Not reporting on this Outcome for this Annual Report

Outcome #8

1. Outcome Measures

Number of research programs to determine the relationship between family lifestyle factors/education and food choices and general health.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	13

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Overweight children are at serious risk for cardiovascular disease, diabetes and some forms of cancer, and the risk is life long. The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity reports that overweight adolescents have a 70% chance of becoming overweight or obese adults, and this risk increases to 80% if a parent is overweight or obese. Further, obesity-associated coronary heart disease is now the No. 1 cause of mortality in the U.S. 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 determine which foods protect against diseases such as cancer; discover health-beneficial constituents in fruits, vegetables and generally regarded as safe plants; identify and assess opportunities for Michigan farmers to pursue organic and place-based production and marketing strategies; determine the impact of phytonutrients on the absorption, distribution, metabolism and elimination of essential nutrients; make it easier for citizens to eat healthier and be physically active; and evaluate the effectiveness of providing resources, education, and technical assistance to low-income households who wish to grow food in their backyards or community gardens to increase household food security and consumption of vegetables.

Results

Since 1981, 88 communities from 43 counties have completed the Web-based Physically Active Communities (PAC) assessment at least once and 30 communities have earned more than one award.

In the U.S., diabetic retinopathy is a leading cause of blindness in adults. Up to 45 percent of adults diagnosed with diabetes in the U.S. have some degree of diabetic retinopathy. Research showed that n6 fatty acids have a pro-inflammatory effect and the major n3 polyunsaturated fatty acid in the retina has a pronounced anti-inflammatory effect on human Retinal Vascular Endothelial cells. The results of this study were presented at American Diabetes Association, Association for Research in Vision and Ophthalmology and Michigan Society of Toxicology annual meetings and published in Diabetes, Investigative Ophthalmology and Visual Science.

Using anti-inflammatory nutrients such as tart cherry extracts and n-3 fatty acids, it was demonstrated that these nutrients have significant inhibitory effects on adipose cell production of inflammatory factors.

The steroidal saponins in the tender shoots of rattan consumed by the Kanawan Aytas in the Philippines have shown to be highly effective as an anti-inflammatory and inhibitory to human tumor cell proliferation in in vitro studies. Similarly, researchers have isolated and characterized anti-inflammatory and tumor cell inhibitory agents in the black poplar mushroom.

For the first time, the role of probiotic bacteria in colonic epithelial cell signaling has been established. Further, the presence of nitrate/nitrite in the diet has been demonstrated to have implications for gastrointestinal cancer. Taken together, these data suggest a reexamination of the scientific basis for potential benefits and risks of dietary nitrate/nitrite.

4. Associated Knowledge Areas

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

1. Outcome Measures

Number of research programs to determine the relationship between environmental influences and obesity/general health/physical activity.
Not reporting on this Outcome for this Annual Report

Outcome #10**1. Outcome Measures**

Number of research programs to determine the biological mechanisms that affect the quality and safety of meat food products.
Not reporting on this Outcome for this Annual Report

Outcome #11**1. Outcome Measures**

Number of research programs to develop improved methods to assess the allergen-causing potential of foods.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	1	1

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Food allergies account for more than 200 deaths and 30,000 emergency room visits in the U.S. every year. Because there is no cure for food allergies, the best course is to prevent problems by strictly avoiding allergy-causing food. One of the biggest problems is verifying whether a particular product contains an allergenic agent. Although protocols are in place to ask questions about the allergy-causing possibilities of genetically engineered crops, no validated test is available to offer definitive answers.

What has been done

An MAES researcher has developed a mouse-based model to determine the allergenic potential of genetically engineered crops. The model also provides the opportunity to better understand how the immune system makes its decision to react as it does to a non-toxic substance in food and why this happens only in certain people.

Results

During 2007-2008, further testing was done on cashew nut and milk proteins using the model. The tests produced allergic responses similar in feature to human allergic reactions. If this model proves effective, it could be available commercially in three to five years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
723	Hazards to Human Health and Safety

Outcome #12**1. Outcome Measures**

Number of research programs to develop new techniques that are fast, efficient, easy to use and easy to interpret to detect toxins in foods, especially *Listeria*, *Salmonella*, *E. coli* O157:H7 and *Campylobacter*.

Not reporting on this Outcome for this Annual Report

Outcome #13

1. Outcome Measures

Number of research programs to develop processing techniques to optimize the safety of processed protein-based foods.

Not reporting on this Outcome for this Annual Report

Outcome #14

1. Outcome Measures

Number of research programs to develop new methods to reduce the transmission of food-borne pathogens.

Not reporting on this Outcome for this Annual Report

Outcome #15

1. Outcome Measures

Number of research programs to develop new methods to control pests in foods that reduce or eliminate chemical residues on food.

Not reporting on this Outcome for this Annual Report

Outcome #16

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	Quantitative Target	Actual
2008	1	4

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 divers 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 study chronic respiratory diseases caused by air pollutants to better understand how nasal tissues and cells may respond to inhaled toxicants; explore the mechanistic linkages between molecular phenotype and toxicity outcomes; assess the toxicity of endocrine disruptor mixtures; and close the gap that exists regarding the specific components of air pollution that influence pulmonary neoplasia.

Results

Recent studies suggest that inhaled particulate matter in the nasal airways send signals to the brain which, in turn, may alter normal breathing and cardiovascular function. The study of infant monkeys show that those exposed to pollutants at an early age suffer greater damage to their airways than would similar airways in adults exposed to the same pollutant levels. The difference in the severity of airway damage in laboratory animals was significant, suggesting that children may be more susceptible than adults. Work is underway to build a three-dimensional computer image of the entire respiratory tract to help predict what airborne concentrations of ozone, particulate matter and other pollutants are harmful to the respiratory system of children and adults. Results will be used to better protect the public from the damaging effects of air pollution.

4. Associated Knowledge Areas

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

Outcome #17

1. Outcome Measures

Number of research programs to develop new programs and policies to help young people move successfully from foster care to independent living after they are too old for foster care.

Not reporting on this Outcome for this Annual Report

Outcome #18

1. Outcome Measures

Number of research programs to 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.

Not reporting on this Outcome for this Annual Report

Outcome #19

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	Quantitative Target	Actual
2008	1232	1216

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The top three causes of death as reported by Michigan Department of Community Health are heart disease, stroke and cancer. Gratiot County has a death rate from stroke that is nearly twice the state average.

According to the Department of Community Health 'The risk of stroke can be greatly reduced by making healthy lifestyle choices.' An overwhelming amount of research shows a correlation between lifestyle choices and reduction in heart disease and certain cancers as well. Obesity is also at epidemic levels in these counties as well as the rest of the state of Michigan. This condition can also be affected by making healthy lifestyle choices.

What has been done

One example is 'Eating Your Way to Good Health' program that was presented to both 6th-8th graders and parents. The program topics were 'Kids and Diabetes: What's a Parent to Do' and 'Children and Obesity: What's a Parent to Do?' The programs focused on portion control, healthy meals, healthy snacks, fitness, encouraging physical activity, and healthy beverage choices. Radio shows, newsletter articles and press releases were also used throughout the year.

Results

85% of the parents attending the program showed an increase in knowledge related to the causes of childhood diabetes and childhood obesity and overweight. After attending the program participants were able to state three steps to take in trying to help their families and children change their lifestyles to prevent these diseases. In another example, more than 460 participants in the Breastfeeding Initiative (BFI) exclusively breastfed their infants for at least six months, saving the state an estimated \$335,000 in WIC costs and Medicaid expenditures in FY 2008 as well as reducing the possibility of childhood obesity among these infants. Pre- and post-program evaluations show that MSUE's youth nutrition programs in 2008 caused significant increases in healthy behaviors, including hand-washing, choosing healthy snacks, being physically active every day and eating vegetables every day.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

Outcome #20

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	Quantitative Target	Actual
2008	1141	2021

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The top three causes of death as reported by Michigan Department of Community Health are heart disease, stroke and cancer. Gratiot County has a death rate from stroke that is nearly twice the state average.

According to the Department of Community Health 'The risk of stroke can be greatly reduced by making healthy lifestyle choices.' An overwhelming amount of research shows a correlation between lifestyle choices and reduction in heart disease and certain cancers as well. Obesity is also at epidemic levels in these counties as well as the rest of the state of Michigan. This condition can also be affected by making healthy lifestyle choices.

What has been done

One example is 'Eating Your Way to Good Health' program that was presented to both 6th-8th graders and parents. The program topics were 'Kids and Diabetes: What's a Parent to Do' and 'Children and Obesity: What's a Parent to Do?' The programs focused on portion control, healthy meals, healthy snacks, fitness, encouraging physical activity, and healthy beverage choices. Radio shows, newsletter articles and press releases were also used throughout the year. MSU Extension partnered with schools, medical clinics and hospitals in conducting health fairs.

Results

80% of the students attending a classroom series were able to name the five food groups as well as be able to identify how to keep their food safe. After attending the health fair, 75% of students were confident that they could make a healthy lifestyle behavior change. In another example, MSUE's Youth Farm Stand projects resulted in a 70 percent increase in children eating fruits and vegetables and a 62 percent increase in children choosing healthier snacks. These outcomes directly address Michigan's crisis-level youth obesity issue.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development
724	Healthy Lifestyle

Outcome #21

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 Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	1494	3097

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The quality of parenting is highly correlated with children's outcomes that include academic, social, emotional, physical and intellectual development.

What has been done

MSU developed Building Strong Families as an innovative approach to delivering parenting education to limited resource parents with children 0-3. BSF was designed to help parents and caregivers help their children reach their fullest potential. MSU Extension provides parenting education for at-risk families with children between the ages of 0-19.

Results

88% of the participants increased in their understanding of human development, positive discipline, use of play for stimulation and attachment, goal setting, and anger management. In another example, in St. Clair County, 49 families with a total of 70 children received in-home parenting education through MSUE. Many were referred from Department of Human Services, Head Start, county hospitals and other agencies dealing with at-risk families. Extensive research has shown that in-home parenting education results in a 78 percent decline in verified reports of child abuse, 30 fewer months on welfare and a 56 percent decline in arrests of the children as they grow older.

4. Associated Knowledge Areas

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

Outcome #22

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	Quantitative Target	Actual
2008	719	2372

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Stakeholders identified as a top priority to help youth increase their knowledge of human development and family well being in order improve their quality of life as they become adults.

What has been done

4-H programs using volunteers have been established to teach youth about human development and family well being.

Results

Surveys indicate approximately 85% of the youth increased in knowledge areas regarding personal development, human development, child development, parenting and family life education.

4. Associated Knowledge Areas

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

Outcome #23**1. Outcome Measures**

Number of adult participants with increased knowledge of community insitutions, health and social services.

2. Associated Institution Types

•1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	117	141

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Families with children ages 0 3 are often left to their own accord. There is not a strong support system, particularly in the rural areas, if you do not have immediate family support. The family support one does receive may only be based upon family experience, verses some research based education. Issues such as child abuse and neglect cut across economic classes. Abuse and neglect may occur because the person does not understand the needs of a very young child.

What has been done

One program that teaches adults about health and social services resources is Welcome Newborns program. The program provides research based information directly to families and teaches families how to access health and social services in the community.

Results

Evaluation results found 89% indicated they could identify local resources that were helpful to them. 84% indicated they had a better understanding of their baby's needs after utilizing Welcome Newborn materials. 93% indicated they were confident in their parenting skills. 84% indicated they were able to keep their temper better when their child was difficult. 84% indicated they felt they were a more informed and better parent. 98% indicated an understanding of the importance of immunizations. 82% indicated they have read to their child since birth. 96% indicated they understood the nutritional needs of their child. 93% indicated they understood the danger of secondhand smoke with their child. 80% stated they increased their knowledge of Sudden Infant Death Syndrome.

4. Associated Knowledge Areas

KA Code	Knowledge Area
805	Community Institutions, Health, and Social Services

Outcome #24

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	Quantitative Target	Actual
2008	417	1707

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Each year, Michigan 4-H Youth Development involves more than 25,000 adults in providing fun, hands on learning opportunities to more than 200,000 Michigan young people. 4-H also provides volunteer training opportunities to foster and support positive youth development. It is critical that volunteers have a strong knowledge of youth development.

What has been done

Trainings have been conducted to further develop adult volunteers' knowledge of youth development (especially new volunteers) as well as create safe environments for young people to learn, have fun and develop socially, and ensure that the adults we entrust to work with young people only have the best interests of youth at heart. The Michigan State University Extension Volunteer Selection Process is a tool used to recruit and orient volunteers who will be involved with young people for long term, overnight or extended involvement.

Results

Approximately 95% of the new adult volunteers trained showed competent levels of youth development.

4. Associated Knowledge Areas

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

Outcome #25

1. Outcome Measures

Number of youth 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	Quantitative Target	Actual
2008	1901	2003

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Each year, Michigan 4 H Youth Development involves more than 10,000 teens in providing fun, hands on learning opportunities to more than 200,000 Michigan young people. 4 H also provides volunteer training opportunities to foster and support positive youth development. It is critical that all (teen and adult) volunteers have a strong knowledge base of youth development.

What has been done

Trainings have been conducted to further develop teen volunteers' knowledge of youth development as well as create safe environments for young people to learn, have fun and develop socially, and ensure that the teens we entrust to work with young people only have the best interests of youth at heart.

Results

Approximately 97% of the teen volunteers demonstrated competency in youth development and club management.

4. Associated Knowledge Areas

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

Outcome #26**1. Outcome Measures**

Number of native american adults with improved knowledge and skills in tribal governance.

2. Associated Institution Types

•1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	30	28

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

American Indian Members of Federally Recognized Tribal Communities in Michigan have been increasing over the past 25 years. This increase in members has created a complex need to develop governing capacity among the recognized tribes and to help Tribal Councils deal with more complex and difficult financial, governance, planning, inter-governmental cooperation and leadership issues.

What has been done

MSUE has assisted other governmental units to increase their capacity in these areas through a variety of capacity building and training programs, such as 'New County Commissioners Training, Citizen Planner, Working with Treasures and Clerks, and leadership development programs'. At the request of the Grand Traverse Band of Ottawa and Chippewa Indians, MSUE created a capacity building program to help tribal governance.

Results

98% of participants at the workshop reported knowledge gains in these areas.

4. Associated Knowledge Areas

KA Code	Knowledge Area
803	Sociological and Technological Change Affecting Individuals, Families and Communities
805	Community Institutions, Health, and Social Services

Outcome #27**1. Outcome Measures**

Number of research programs to increase understanding and develop more effective environmental management systems.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	{No Data Entered}	4

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 evaluate of the anticipated socioeconomic benefits and costs associated with appropriate land use alternatives, including their anticipated environmental impacts; explore information technology in planning vacations, nonmotorized transportation and consideration of wildland fire risks by homeowners and answer questions posed to researchers by industry and government agencies; and assess the distributions and benefits of public parks and open spaces in various communities (urban, suburban and rural) throughout Michigan and beyond.

Results

MAES researchers provided expert testimony and scientific data to Michigan Department of Transportation planners to inform their planning and research functions. Two statewide transportation research summits were held where MAES researchers and DOT executives and staff deliberated and integrated research and best practices into future programs and investments in the state's transportation infrastructure.

Related to the international urban and rural development project, a risk analysis model was developed to systematically assess migration as a coping strategy to mitigate environmental hazards such as volcanic eruptions on small islands. Results were presented at the UN Conference in Bonn.

4. Associated Knowledge Areas

KA Code	Knowledge Area
803	Sociological and Technological Change Affecting Individuals, Families and Communities

Outcome #28**1. Outcome Measures**

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

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	{No Data Entered}	8

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 sectors are critical to human development and overall well-being.

What has been done

Research to build one or more models of preventive and early intervention for children living with a family member with a serious mental illness; examine the relationship between the number of foster home placements for a youth and the number of community connections as emancipated adults; develop healthcare packaging that is easier to access, particularly for aging consumers and people with disabilities; develop a curriculum model for ANR education that encourages Michigan's secondary program for ANR education to become more rigorous and relevant and better prepare students to transition into careers to become productive, economically self sufficient citizens; and to experiment with electronic environmental reporting to help rural communities keep pace with the ever-increasing digital exchange of information.

Results

MSU is the only University to have faculty dedicated to issues in medical packaging. In 2008, this unit created the Web site, www.msu.edu/~bixlaura, to disseminate findings related to packaging for health, universal design and biomechanics. The team also continues to refine two new systems to develop healthcare packaging that is easier to access, particularly for aging consumers and people with disabilities. The systems are being calibrated and are scheduled to be fully operational within the next two years.

Research also generated enough knowledge to begin developing models of preventive and early intervention for youth living with a family member with a psychiatric illness. A comprehensive list of resources for the children is completed and will be disseminated to statewide human health and human services agencies.

The final collection of data from 72 foster care alumni who participated in the research study was completed. Presentations on the findings were made in 2008 at the annual statewide Child Abuse and Neglect Conference and the MSU Outreach Conference. A framework of principles titled Connections, Continuity, Dignity and Opportunity was developed in 2007 and continues to be distributed to foster care and related agencies and staff.

The Great Lakes Wiki partnered with groups in Michigan to develop new, collaborative approaches to sustainable communities and to enhance the future of Michigan citizens. In the past year, portals have been built into the site designed to coax public involvement, such as the Great Lakes vacation memories, Great Lakes artists and Great Lakes writers. The site is bringing urban and rural communities together to preserve the world's greatest fresh water resource.

4. Associated Knowledge Areas

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

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

We continue to review and refine planned program and outcome measure reporting in this report, hence the significant number of outcomes marked, "Not reporting on this outcome measure." In moving from five planned programs to six, some projects were moved into different planned programs than they were previously reported. In other instances, outcome measures were folded in to broader outcome measure categories to make reporting easier and more consistent. Further, the targets in this report (as they were in the previous year's report) compared to actuals aren't necessarily due to unmet goals, but rather a reconfiguration of goal associations and knowledge areas.

V(I). Planned Program (Evaluation Studies and Data Collection)**1. Evaluation Studies Planned**

- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Time series (multiple points before and after program)
- Case Study
- Comparisons between program participants (individuals,group,organizations) and non-participants
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.
- Comparison between locales where the program operates and sites without program intervention

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

Program #2

V(A). Planned Program (Summary)

1. Name of the Planned Program

Soil, Water and Natural Resources

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%		2%	
102	Soil, Plant, Water, Nutrient Relationships	19%		15%	
111	Conservation and Efficient Use of Water	12%		15%	
112	Watershed Protection and Management	15%		10%	
123	Management and Sustainability of Forest Resources	8%		7%	
131	Alternative Uses of Land	18%		15%	
132	Weather and Climate	1%		10%	
133	Pollution Prevention and Mitigation	12%		15%	
134	Outdoor Recreation	1%		0%	
135	Aquatic and Terrestrial Wildlife	5%		8%	
806	Youth Development	8%		3%	
Total		100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	45.0	0.0	15.0	0.0
Actual	24.0	0.0	16.0	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
1129130	0	1790442	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1129130	0	1505325	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	8621964	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research 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.

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 greenhouse gas mitigation strategies.

Develop management techniques for potato and vegetable growers that includes cover crops.

Determine how wildlife responds to ecosystem management decisions in forest and agricultural systems.

Quantify the benefits and costs of a sample green roof system installed on campus.

Determine how wildlife responds to ecosystem management decisions in forest and agricultural systems.

Explore the relationship between soil properties and crop yield.

Explore the occurrence, transport and fate/effect of organic contaminants, chemicals, pesticides, pharmaceuticals and particulates in soil.

Analyze key soil characteristics to better assess their agricultural and environmental contribution.

Investigate fish population dynamics and the management of Great Lakes fisheries.

Strengthen to security, stewardship and management of Michigan's water resources.

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.

V(E). Planned Program (Outputs)**1. Standard output measures****Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	5124	10248	3672	0
2008	5144	10288	7670	15340

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

Year	Target
Plan:	6
2008 :	1

Patents listed

US Provisional Patent App. Filed 7/18/2008, titled 'Compositions And Methods Of Modulating Aquatic Animal Behavior.'

In addition, one patent was issued:

Canadian Patent No. 2,396,521 issued 11/17/07, titled 'Bile Compound and Method of Controlling Behavior of Lampreys Therewith.'

3. Publications (Standard General Output Measure)**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan	10	25	
2008	0	49	49

V(F). State Defined Outputs**Output Target**

Output #1**Output Measure**

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

Year	Target	Actual
2008	11	43

Output #2**Output Measure**

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

Year	Target	Actual
2008	800	821

Output #3**Output Measure**

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

Year	Target	Actual
2008	234	590

Output #4**Output Measure**

- Number of adult participants trained in conservation and efficient use of water.

Year	Target	Actual
2008	767	318

Output #5**Output Measure**

- Number of youth participants trained in conservation and efficient use of water.

Year	Target	Actual
2008	711	2919

Output #6**Output Measure**

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

Year	Target	Actual
2008	1151	821

Output #7**Output Measure**

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

Year	Target	Actual
2008	1422	2919

Output #8**Output Measure**

- Number of adult participants trained in management and sustainability of forest resources.

Year	Target	Actual
2008	1352	1084

Output #9**Output Measure**

- Number of youth participants trained in management and sustainability of forest resources.

Year	Target	Actual
2008	445	409

Output #10**Output Measure**

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

Year	Target	Actual
2008	732	1598

Output #11**Output Measure**

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

Year	Target	Actual
2008	763	608

Output #12

Output Measure

- Number of adult participants trained in pollution prevention and mitigation.

Year	Target	Actual
2008	322	502

Output #13

Output Measure

- Number of youth participants trained in pollution prevention and mitigation.

Year	Target	Actual
2008	97	225

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	New land use models for Michigan communities. We will start with identifying areas of the state that have the infrastructure available to support new development and develop land use planning models for them.
2	Number of research programs to 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.
3	Number of research programs to discover new knowledge about the composition, organization and fluctuations of microbial populations in the soils.
4	Number of research programs to develop 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.
5	Number of research programs to develop greenhouse gas mitigation strategies.
6	Number of research programs to develop management techniques for vegetable growers that include cover crops.
7	Number of research programs to develop new nitrogen application recommendations for turf managers.
8	Number of adult participants with increased knowledge of watershed protection and management.
9	Number of research programs to develop a management system for Michigan inland lakes that does not involve sampling the lakes.
10	Number of youth participants with increased knowledge of watershed protection and management.
11	Number of research programs to develop Total Maximum Daily Load (TMDL) assessment tools for evaluation of Michigan watersheds.
12	Number of adult participants with increased knowledge in management and sustainability of forest resources.
13	Number of research programs to determine how wildlife responds to ecosystem management decisions in forest and agricultural systems.
14	Number of youth participants with increased knowledge in management and sustainability of forest resources.
15	Number of research programs to quantify the benefits and costs of a sample green roof system installed on campus.
16	Number of adult participants with increased knowledge of alternative uses of land.
17	Number of adult participants with increased knowledge of soil, plant, water and nutrient relationships.
18	Number of youth participants with increased knowledge of alternative uses of land.
19	Number of youth participants with increased knowledge of soil, plant, water and nutrient relationships.
20	Number of adult participants with increased knowledge of pollution prevention and mitigation.
21	Number of adult participants with increased knowledge of conservation and efficient use of water.
22	Number of youth participants with increased knowledge of conservation and efficient use of water.
23	Number of youth participants with increased knowledge of pollution prevention and mitigation.
24	Number of research programs that explore the relationship between soil properties and crop yield.
25	Number of research programs that explore the occurrence, transport and fate/effect of organic contaminants, chemicals, pesticides, pharmaceuticals and particulates in soils.
26	Number of research programs that analyze key soil characteristics to better assess their agricultural and environmental contribution.
27	Number of research programs that deal with fish population dynamics and the management of Great Lakes fisheries.
28	Number of research programs that deal with the security, stewardship and management of Michigan's water resources.

Outcome #1**1. Outcome Measures**

New land use models for Michigan communities. We will start with identifying areas of the state that have the infrastructure available to support new development and develop land use planning models for them.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	1	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 reports indicate that by 2020 farmers will have only enough land to meet the nation's domestic food needs.

What has been done

Research to use analytical geospatial methods, regional databases, simulation models and new sensor technologies to assess change in natural and managed ecosystems; use crop and crop stress models at regional scales and evaluate environmental databases for predicting the occurrence and severity of water, nutrient and disease stresses at regional scales; increase management capacity among agencies to better integrate biological and human dimensions of management in wicked problems, such as wildlife health management; and improve our understanding the dynamics of agricultural land use changes under both socioeconomic and climatic drivers;

Results

An index for drought was developed and will continue to be evaluated in relation to corn yield for use in the North Central region. A fungal spore sampler (the Burkard Spore Trap) was modified to allow visualization and real time observation of fungal spores.

A software and system was developed for a new sensor unit that was deployed in several locations to assess change in natural and managed ecosystems. Sensor platforms were deployed in cooperation with the Michigan Department of Natural Resources as part of a frog and toad survey.

A remote sensing algorithm was developed and implemented to map the changes in corn and soybean crops from 2000 to 2007 across the entire United States. In addition, a dynamic link between agricultural land use and regional climate model was implemented to simulate climate changes under different land uses and land covers. The most significant achievement of this research was the development of an interactive assimilation technique that significantly improves simulation (and therefore forecasting) accuracy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
132	Weather and Climate

Outcome #2**1. Outcome Measures**

Number of research programs to 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.

Not reporting on this Outcome for this Annual Report

Outcome #3

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	Quantitative Target	Actual
2008	3	8

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 global warming potential, 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 the metabolism of such microbes drives many ecosystem-level processes.

What has been done

Research to determine how well the most promising candidate strains of cereal-adapted rhizobia perform as superior biofertilizer inoculants for rice and wheat when scaled up to full-size farmer plots; investigate novel cultivation strategies and cultivation-independent molecular techniques to advance our understanding of microbes and microbial communities in soil; and develop new technologies to control soilborne diseases.

Results

Studies conducted at MSU and in the Nile delta of Egypt show that clover rhizobia naturally colonize rice plants in field rotations with legumes, and can be exploited to significantly improve cereal crop growth, resulting in increased grain productivity and agronomic fertilizer N-use efficiency with less dependence on nitrogen fertilizer inputs to maximize crop yield.

Research on soybean white mold to determine the efficacy of commercial biological control agents showed that Contans (*Coniothyrium minitans*) had the best result to eliminate the sclerotia of *Sclerotinia* in soil (reduction of 100% of sclerotia at a higher dosage), and reduce disease incidence. This product can be applied in Michigan.

Research on potato common scab confirmed a field that is suppressive to pathogen *Streptomyces scabies* that will serve as a baseline for further experiments. Researchers have also isolated and characterized a novel strain of *Streptomyces* species that is different genetically with other known potato common scab pathogens but causes the same symptom on potato tubers. This may change the knowledge that Michigan has only one species of pathogen.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources

Outcome #4

1. Outcome Measures

Number of research programs to develop 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.

Not reporting on this Outcome for this Annual Report

Outcome #5

1. Outcome Measures

Number of research programs to develop greenhouse gas mitigation strategies.

Not reporting on this Outcome for this Annual Report

Outcome #6

1. Outcome Measures

Number of research programs to develop management techniques for vegetable growers that include cover crops.

Not reporting on this Outcome for this Annual Report

Outcome #7

1. Outcome Measures

Number of research programs to develop new nitrogen application recommendations for turf managers.

Not reporting on this Outcome for this Annual Report

Outcome #8

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	Quantitative Target	Actual
2008	978	698

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Results from the Issue Identification process found safe water as one of the top 10 priorities. Knowing water is contaminated, provides residents with information to help them protect their health. Water screening raises awareness of possible groundwater contamination. Screening may also lead people to think more about protecting water quality by activities around their home site.

What has been done

One example is the Northern Water Quality District Agent, working with the Michigan Groundwater Stewardship Program (MGSP), organized the outreach, coordination and the collection of drinking water well samples for screening for nitrates, nitrites and triazine pesticides at AgExpo. The educator organized 45 media releases and wrote an article promoting water testing for the Grand Traverse Herald (circ. 15,105). These generated a great deal of interest in water testing. The MGSP provided the state-wide, free screening at AgExpo. The MGSP is a cooperative effort between Michigan State University Extension, Michigan Department of Agriculture, United States Department of Agriculture's Natural Resources and Conservation Service, and AmeriCorp with close coordination with the Michigan Association of Conservation Districts, Michigan Farm Bureau, and the Michigan Agri-Business Association. The Northern District agent's region provided 76% of the 1,871 samples screened. These 1,376 samples came from 22 counties. Three wells tested positive (greater than 0.1 parts per billion (ppb) but less than 0.6 ppb) for triazines, a widely-used, highly leachable group of weed killers. Seventy eight samples had greater than 10 but less than 20 parts per million (ppm) nitrate. The national nitrate standard is 10 ppm. Ten ppm or higher is considered hazardous to babies and pregnant women causing the baby's blood to not be able to carry adequate oxygen (methemoglobinemia, otherwise known as blue-baby syndrome). Three samples had greater than 20 ppm nitrate with two wells providing water with 50 ppm nitrate! Only one sample showed high nitrite levels. This sample from Leelanau County had greater than 0.2 ppm nitrite but less than 1 ppm. The U.S. national standard is 1 ppm. There was an inverse correlation between contamination and well depth. These data are not necessarily representative of all wells in the 22 counties since participation was self-selecting and therefore not a random survey.

Results

Residents in the 22 counties benefited from \$23,392 worth of free water screening accessed through the MGSP. Additionally residents in 8 counties benefited by familiarization with the location of the MSUE office and to the services offered by Extension through the distribution of a brochure when people came to pick up sample bottles and sampling directions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

Outcome #9

1. Outcome Measures

Number of research programs to develop a management system for Michigan inland lakes that does not involve sampling the lakes.

Not reporting on this Outcome for this Annual Report

Outcome #10

1. Outcome Measures

Number of youth 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	Quantitative Target	Actual
2008	1208	2569

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

One example, Grand Haven Offshore Classic requested that a MSUE educator design a presentation for students involved in the Salmon in the Classroom program funded by his salmon tournament organization. The class focused on the role of Chinook salmon in Lake Michigan's food web and its importance to coastal communities and to the ecology.

What has been done

Six classrooms in three school districts participated in a program designed to teach students the role of Chinook salmon in Lake Michigan ecology and coastal economies. These classrooms were involved in raising Chinooks, which would soon be released into Lake Michigan or tributaries, providing a teachable moment.

Results

This was a youth education effort that sought to draw connections between students, the fish they raise, the Great Lakes, the water they drink, the beaches they enjoy, the cities they live in, and the anglers and fishery managers who contribute to the health of the integrated whole. The MDNR was involved in training teachers involved and supplying eggs. The youth were involved in raising Chinooks, which were released into Lake Michigan or tributaries that provided a teachable moment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
806	Youth Development

Outcome #11**1. Outcome Measures**

Number of research programs to develop Total Maximum Daily Load (TMDL) assessment tools for evaluation of Michigan watersheds.

Not reporting on this Outcome for this Annual Report

Outcome #12**1. Outcome Measures**

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

2. Associated Institution Types

•1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	1149	921

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The Sustainable Forestry Education Program (SFE) is a MSUE program funded nearly 100% by American Forest & Paper Association (AF&PA) forest industry members in Michigan. Most of the large paper, pulp and panel board companies in Michigan are members of AF&PA (Mead Corp., Champion Int'l. Corp., Weyerhaeuser Co., etc.). MSUE conducts educational programs for primarily loggers (but foresters and private landowners also attend) to increase their professionalism in the logging industry. Most of the AF&PA forest industry members require that all the loggers supplying their mills attend the basic SFE Core Program and at least 8 hours of continuing education per year after completing the core program.

What has been done

Most MSUE SFE Programs are a combination of indoor classroom presentations coupled with an outdoor field tour, field exercise or demonstration project. American Forest & Paper Association Forest Industry members in Michigan (most of the large forest industry corporate members; Michigan Forest Resource Alliance; Michigan Tech University and Bay de Noc Community College, Michigan Association of Timbermen and others. None specifically. All MSUE SFE programs are open to one and all as with any MSUE educational program. If requested, MSUE SFE would consider modifying any educational program to accommodate diverse audiences.

Results

85% of the participants increased their knowledge in management and sustainability best practices of forest resources.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

Outcome #13

1. Outcome Measures

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

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A better understanding of wildlife-habitat relationships as influenced by natural and managed wildlife habitat disturbances is needed. in order to make more effective natural resource decisions to conserve wildlife populations, communities and habitat.

What has been done

Research to address quantifying wildlife use of forest and agriecosystems, including evaluating white-tailed deer, elk, snowshoe hare and eastern massasauga rattlesnake movements, population dynamics and habitat selection patterns in response to land cover and use patterns.

Results

A new population estimation technique was developed to quantify the elk population size in Michigan. This technique is being used by the Michigan Department of Natural Resources (MDNR) as their standard procedure and used for harvest management.

A bovine tuberculosis simulation model is also being developed, in cooperation with the MDNR to investigate the spread of the disease, impacts of vaccinations and influences on deer population dynamics. Upon model completion, it will be used to evaluate the effectiveness of deer management practices to decrease TB prevalence.

Researchers also developed an aspen data base that describes the habitat types in the western region of the Upper Peninsula that supports aspen and is used by wildlife species (white-tailed deer, ruffed grouse) and communities (songbirds, plants). The data base was presented to the MDNR to plan habitat and forest management practices. A spatial forest simulation model was developed so that managers can see how aspen management practices impact the spatial availability of aspen and wildlife habitat quality.

4. Associated Knowledge Areas

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

Outcome #14**1. Outcome Measures**

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	379	359

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

In one example, youth in Ontonagon County in the Upper Peninsula of Michigan on the shores of Lake Superior are surrounded by dense forests, which are home to industry, wildlife and our communities. Based on stakeholder input, 4-H decided to expose more youth to a deeper understanding of their local forests and the issues that our county's communities face in relation to these forests. The goal was that youth would be more knowledgeable about their local natural resources, it's issues and opportunities.

What has been done

The program was developed in partnership with Ontonagon County Conservation District Forester, U.S. Forest Service, and MSUE. The program was offered in public schools grades two through six in the Upper Peninsula.

Results

89% of the youth increased their knowledge on Michigan and local forests and, specifically, learned about land use, environmental stewardship, outdoor education, wildlife, and management of forests.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development
123	Management and Sustainability of Forest Resources

Outcome #15**1. Outcome Measures**

Number of research programs to quantify the benefits and costs of a sample green roof system installed on campus.

Not reporting on this Outcome for this Annual Report

Outcome #16**1. Outcome Measures**

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	622	1359

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The economic limitations of local budgets prevent many communities in Michigan from retaining professional assistance in planning and land use that would help protect and sustain these local resources. Regional Planning Organizations, Local Unit Administrators, Local Zoning Boards, and Non-profit groups have requested education and facilitation in decisions about land use.

What has been done

MSUE developed an educational program that increases the capacity of local officials and citizen groups to deal effectively with land use issues.

Results

Since 2000, the MSU Small Town and Community Design Initiatives (STDI/CDI) have completed or are currently working on 57 projects, in 69 communities, across 31 Michigan counties. In each case, MSUE, has been an integral and significant partner. Projects have included downtown revitalization, streetscapes, park design, county fairgrounds master plans, community image develop, beautification, waterfront development, neighborhood renewal, transportation systems and community branding. In almost all cases, there has been a direct relationship to community economic development. Communities have used the STDI/CDI documents to work with their consultants, local and regional planning agencies, downtown development authorities, volunteer groups, and state agencies such as MDOT. Communities have also applied for and received grants totaling about \$4 million to make improvements recommended by the STDI/CDI.

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land

Outcome #17**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	Quantitative Target	Actual
2008	681	698

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Accelerated fertilizer prices have continuee to make a teachable moment for crop farmers, as well as livestock producers to utilize manure nutrients. Along with a positive side, there is the important component of nutrient balancing, environmental protection, GAAMPs conformance, tile drains and runoff control. This MSUE program focused on educating and supporting decision makers in developing and implementing nutrient plans.

What has been done

One example where over 100 producers and agribusiness agronomists participated in a series of regional programs to improve nutrient/fertility management decisions.

Results

The host educators distributed the evaluation form to participants at the conclusion of each program. Over 98 percent of the participants reported new knowledge gains. Seventy-five percent indicated that they planned to use the information they learned to make nutrient/fertility management decisions. Fifty-five percent said that they expect these decisions to make their businesses more profitable. The participants indicated that they planned to earn/save an average of \$14.00 per acre by utilizing the information they learned at the programs. The average number of acres impacted was 305 acres so the average savings/earnings was \$4,275.00 per farm. The benefit to the environment through better management was not calculated.

4. Associated Knowledge Areas

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

Outcome #18**1. Outcome Measures**

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

2. Associated Institution Types

•1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	649	608

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Land use in Michigan is a hot topic. Governor Granholm has made it a priority issue and many new resources and policy recommendations are being put in place. The Governor and community leaders support youth land use education. The 'This Land Is Your Land' learning series is a new MSUE curriculum that is aligned with the Michigan Curriculum Framework for 3rd - 5th grades, however, due to lack of resources is not being promoted on a statewide basis. MSUE responded to this incorporating the learning series into the Junior Citizen Planner Program.

What has been done

The Junior Citizen Planner Program provides a mechanism to engage youth in the larger Citizen Planner Program through education and service learning that includes volunteer hours that earn a certificate, as well as engages 4H youth in actual land use issues.

Results

92% of the youth reported getting involved in local land use issues through their volunteer hours. Ninety-five percent reported knowledge gains in understanding local issues and processes that are helpful in making decisions about land use.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development
131	Alternative Uses of Land

Outcome #19

1. Outcome Measures

Number of youth 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	Quantitative Target	Actual
2008	199	525

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The Huron River Watershed is the largest watershed in Washtenaw County, supplying drinking water to over 150,000 people every day. According to the Huron River Watershed Council, three of the five identified water quality problems in the Huron River are related to land use. They include: impervious surfaces, non point source pollution, and soil erosion and sedimentation. The Huron River Watershed Council has a tremendous volunteer program which works to educate local citizens about the things they can do to improve local water quality. Partnering with the Huron River Watershed Council's resources, MSUE educated local youth about the importance of water quality and the things that diminish it.

What has been done

Michigan was awarded a substantial grant from the Toyota Foundation to work in communities to involve youth in water quality education programs. MSUE in both Washtenaw County and Oakland County worked together to meet the goals of this grant in their local communities. Both communities share the Huron River and Huron River Watersheds and benefited from this collaboration.

Results

In 2008, over 2,000 youth were trained in soil, plant and water relationships with approximately 25% of the funding from formula dollars. Evaluation results suggest 89% of the youth had knowledge gains with 92% had enhanced opportunities to explore their local environment and learn first hand. be working with local leaders who have been very engaged with

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development
102	Soil, Plant, Water, Nutrient Relationships

Outcome #20**1. Outcome Measures**

Number of adult participants with increased knowledge of pollution prevention and mitigation.

2. Associated Institution Types

•1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	273	698

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

While MSU Extension and the MDA have active programs with the goal of educating and assisting livestock farmers with environmental compliance, the existing programs tended to focus on large livestock operation owners and managers. Many small- and medium-sized livestock farms do not fully understand their obligations and the differences between the Michigan Agriculture Environmental Assurance Program (MAEAP), Right to Farm Law, Natural Resource Environmental Protection Act and the definition of a discharge.

What has been done

One example is MSUE's Small- and Medium-Sized Farm Environmental Liability Education Program where owners and managers of small- and medium-sized livestock farms did not fully understand their environmental compliance responsibilities. MSUE developed this program to assist producers with identifying on-farm risks, and offered environmental risk assessment visits by Extension educators.

The small- and mediumfarm environmental liability education programs goal updated owners and managers of these operations on the regulations that impact their operations, reduce field application discharge risks and identify and apply solution principles for facility discharge risks. 27 MSUE educators helped deliver programs in 21 locations throughout Michigan.

Results

The 264 participants included: 218 farmers * 120 dairy, 73 beef, 6 swine, 4 sheep, 2 poultry, 8 horses, 1 goat * combined total of at least 28,000 head 14 Michigan Milk Producers Association staff 15 MDA, Soil and Water Conservation District technicians, Ground Water Stewardship Program technicians and Farm Service Agency staff * 9 environmental engineers/CNMP. Evaluation of these program found 95.2 percent were more conscientious about manure application practices * 68.9 percent planned to adopt a new management practice associated with manure application * 96.2 percent plan to look at farm facilities from a more environmentally-oriented perspective * 72.7 percent plan to make facility management changes * 58 percent plan to make a structural change.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

Outcome #21**1. Outcome Measures**

Number of adult participants with increased knowledge of conservation and efficient use of water.

2. Associated Institution Types

•1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	652	271

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Over the last several years, Issues ID and Focus Groups in most Michigan counties have included water quality and environmental education as priority concerns. Local communities and organizations have requested wetland education to help address wetland preservation issues, and water conservation programs to assist residents in dealing with problems from failing and overburdened water systems along with increased water and sewage rates.

What has been done

In response to this need, MSUE developed and implemented the 'Save Water - Save Money' program on indoor and outdoor water and energy conservation. Participants were taught about uses of water, possible water and energy conservation choices and the importance of conservation.

Results

85% of the participants reported they would use information learned from the course to conserve water and help their community.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water

Outcome #22**1. Outcome Measures**

Number of youth participants with increased knowledge of conservation and efficient use of water.

2. Associated Institution Types

•1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	604	2569

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Research shows teaching youth about water conservation and use of water will lead to better environmental stewards in the future.

What has been done

MSUE developed 4-H projects to address water use and conservation.

Results

It is estimated 85% of the youth gained knowledge in these areas.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
806	Youth Development

Outcome #23**1. Outcome Measures**

Number of youth participants with increased knowledge of pollution prevention and mitigation.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	82	198

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Educating youth who plan to be future farmers about waste management and pollution control will contribute to a better understanding of the relationship between animal agriculture and the environment.

What has been done

MSUE 4-H has developed projects in this area to address this need.

Results

It is estimated that 85% of the youth gained knowledge about pollution prevention and waste management.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
806	Youth Development

Outcome #24**1. Outcome Measures**

Number of research programs that explore the relationship between soil properties and crop yield.

Not reporting on this Outcome for this Annual Report

Outcome #25**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	Quantitative Target	Actual
2008	{No Data Entered}	7

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 fuels for our industry and our business. 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.

What has been done

Research to better understand soil-contaminant interactions and ways to manage and control the effects of contaminants once they enter the soil; better understand variation in the production and consumption of greenhouse gases by microbial communities in soils. develop soil test procedures to identify correlation with crop yield and plant nutrient content; determine relationship between crop yield and estimate the impacts of weather and climate on representative crop production systems in Michigan; and control and convert rural waste to resources - animal waste management strategies, biological, chemical and physical treatment for nitrogen and phosphorus control from crops, food processing wastewater treatment, storm water best management practices, and decentralized wastewater treatment technologies.

Results

Research findings delineated the relative roles and mechanistic function of clays and organic matter in the retention and transformations of pesticides and related organic contaminants by soils.

The global warming potential (GWP) of 11 different cropping and natural ecosystems was calculated using information on soil carbon sequestration; fertilizer, lime, fuel inputs and the production of N₂O and consumption of methane in these systems. Nitrogen dioxide production continues to be the largest single source of GWP in all annual crop ecosystems. These and other results offer significant promise for reducing the global warming potential of agricultural systems, both grain and biofuel-based.

A sensitive and robust analytical method was established to simultaneously measure pharmaceutical levels in water and soil by coupling single-cartridge solid phase extraction with a liquid chromatograph equipped with tandem mass spectrometry (LC-MS/MS). This method will be used to develop and evaluate treatment procedures for these contaminants.

A protocol was developed to determine if food processing waste blended with manure before digesting results in byproducts and will be implemented by the Michigan Department of Agriculture.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
112	Watershed Protection and Management
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships

Outcome #26**1. Outcome Measures**

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

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	{No Data Entered}	8

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 management systems. This includes factors such as climate, nitrogen management, soil absorption and other environmental interactions.

What has been done

Research to study the characteristics of sands and high content soil blends used in athletic fields and golf putting greens; establish field studies for phosphorus and potassium; study relationships between plant characteristics, topography and soil properties with an emphasis on soil carbon and soil characteristics related to carbon sequestration; determine the resource value of various organic and inorganic waste residuals as beneficial amendments to cropland; and move toward diversification with cover crops to enhance nutrient cycling efficiency and rhizosphere traits for resilient, productive row crop systems.

Results

Video images of pore continuity and dead-end pores within soil aggregates have been placed on the principal investigator's Web site. Findings have been presented to at least 400 students in classrooms and scientists at national and international symposiums and conferences.

Application of maintenance amounts of phosphorus and potassium resulted in a 10 % increase in alfalfa yield in 2008 field tests.

Turfgrass research showed that within a 6-week period, more than 52 mm of high sand content root zone material can be added, greatly improving the soil properties and athletic field playability. Findings also show that existing turfgrass on an athletic field continues to grow, develop and improve with the topdressings, suggesting that facilities that adopt an aggressive topdressing program for several years can spread costs over time and greatly improve the performance of their facilities.

Research to determine the environmental impact of trace substances in East Lansing N-Viro Soil and swine NureSoil when land-applied demonstrated that neither treatment had any negative impact on the phytoavailability of soil micronutrients studied and had minimal impact on trace and heavy metal accumulation in these two crops.

Research findings have resulted in improved understanding and practical recommendations to utilize recycling of nutrients and retention of soil organic matter fostered by manure, cover crops, perennial grains and combined technologies. These and other results offer significant promise for reducing the global warming potential of agricultural systems, both grain and biofuel-based. Workshops are being conducted with farmers and Extension educators to discuss negative and positive aspects of cover crop species, seeding techniques, rotation sequences and residue management practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
101	Appraisal of Soil Resources
111	Conservation and Efficient Use of Water

Outcome #27

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	Quantitative Target	Actual
2008	{No Data Entered}	7

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 associated habitats over the past 200 years. Today, the lakes have aquatic communities that are structurally and functionally volatile and that 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 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 to fish to habitat alteration; and investigate critical areas of uncertainty for Great Lakes fishery management, particularly sea lamprey control and salmon stocking.

Results

Research on the relationship between habitat characteristics and fish population dynamics has provided sampling advice for determining median river flows for the Michigan Departments of Natural Resources and Environmental Quality and data to develop a lake sturgeon management plan.

Fish community models to evaluate salmon and trout stocking alternatives on Lakes Huron and Ontario are now operational and being used.

A simulation model of the sea lamprey management system was used to determine Economic Injury Levels (the level of control that can be justified based on a balance of costs and benefits) for all five of the Great Lakes. Data analysis was presented to the Great Lakes Fisheries Commission.

Research also clearly demonstrated that a synthesized copy of male sea lamprey pheromone attracts ovulated females to traps over a long distance and under different stream conditions, and can also disrupt orientation of the females to a natural pheromone. Initial results show that pheromone-baited traps usually catch 70 to 80 percent of the females. The synthesized pheromone is also environmentally-friendly.

4. Associated Knowledge Areas

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

Outcome #28**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	Quantitative Target	Actual
2008	{No Data Entered}	6

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 supports a \$1 billion per year recreational and commercial fishing industry. They also supply drinking water for over 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 develop a landscape-based ecosystem management framework that integrates landscape ecology with natural resource management and policy; determine why sport fish populations, fish assemblages and lake food webs and their response to perturbation, vary among lakes; help develop dynamic, interactive computer interfaces in resource-based recreation management; and understand the potential response of climate and water budget in the Great Lakes region to the common scenarios of global warming.

Results

The Animal Care GAAMPs for Aquaculture were significantly revised in 2008 (using our research data) to include an update of commercial aquaculture activities in Michigan, sources of specific information on the husbandry and state regulations pertaining to aquaculture species reared in the state.

Research on the landscape ecology of lake ecosystems has resulted in six publications that have led to new fundamental and applied understanding of Michigan lakes. The main lake-landscape database used for Michigan lakes was also updated using finer resolution spatial data, making it one of the best in the state for these lakes.

Researchers have developed a regional climate change modeling framework to more accurately project water budget changes specific to the Great Lakes region.

MSU's Usability and Accessibility Center assisted with an evaluation of the usability and aesthetics of one portion of the Natural Resource Management Gateway: the Lake Discovery Web site (<http://corpslakes.usace.army.mil/discovery/discovery.html>). Six new prototypes for the Web site were created and evaluated in one-on-one sessions with 40 park personnel. A final report with recommendations for modifications in navigation, information architecture and content categories was submitted.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management

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

We continue to review and refine planned program and outcome measure reporting in this report, hence the significant number of outcomes marked, "Not reporting on this outcome measure." In moving from five planned programs to six, some projects were moved into different planned programs than they were previously reported. In other instances, outcome measures were folded into broader outcome measure categories to make reporting easier and more consistent. Further, the targets in this report (as they were in the previous year's report) compared to actuals aren't necessarily due to unmet goals, but rather a reconfiguration of goal associations and knowledge areas.

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- After Only (post program)
- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Case Study
- Comparisons between program participants (individuals, group, organizations) and non-participants
- Comparison between locales where the program operates and sites without program intervention

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

Program #3

V(A). Planned Program (Summary)

1. Name of the Planned Program

Plant Sciences

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	5%		13%	
202	Plant Genetic Resources	6%		5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	7%		7%	
204	Plant Product Quality and Utility (Preharvest)	5%		5%	
205	Plant Management Systems	30%		20%	
206	Basic Plant Biology	3%		6%	
211	Insects, Mites, and Other Arthropods Affecting Plants	3%		12%	
212	Pathogens and Nematodes Affecting Plants	15%		12%	
215	Biological Control of Pests Affecting Plants	3%		5%	
216	Integrated Pest Management Systems	20%		15%	
806	Youth Development	3%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	27.0	0.0	19.0	0.0
Actual	36.4	0.0	25.0	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
1627680	0	2785132	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1627680	0	2341617	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	13411944	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and Extension activities undertaken to:

Develop insect and disease control strategies and cultural and management strategies for crops that meet UDSA certified organic standards.

Develop biological controls for pests, insects and diseases to minimize any effects on the environment.

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.

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, private citizens, agriculture and natural resources industry representatives, biotechnology company representatives, state agencies and Native American growers.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	7992	15984	1717	0
2008	16317	32634	6107	0

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

Patent Applications Submitted

Year Target
Plan: 11

2008 : 12

Patents listed

European Patent App. Filed 3/27/2008, titled 'F-box Protein Targeted Plant Oil Production(TEC2005-0039-01EP).

Indian Patent App. Filed 4/11/2008, titled 'F-box Protein Targeted Plant Oil Production'(TEC2005-0039-01IN).

PCT Patent App. Filed 6/23/2008, titled 'Engineered Plant extracellular Lipids Using Acyltransferases and Fatty Acid Omega-Oxidases'(TEC2007-0095-01PCT).

US Patent Application filed 11/14/2007 titled 'A Method for Producing Biodiesel'(TEC2007-0004-01).

PCT Patent Application filed 11/15/2007 titled 'Method for Producing Biodiesel'(TEC2007-0004-01PCT).

PCT Patent Application filed 2/6/2008,titled 'Composition and Methods for Drought Tolerance'(TEC2003-0035-01PCT).

PCT Patent Application filed 5/12/2008, titled 'Introgression of Festuca Mairei Drought Tolerant Genome into Lolium Perenne Plants'(TEC2003-0035-03PCT).

US Patent Application filed 2/7/2008, titled 'Compositions and Methods for Drought Tolerance(TEC2003-0035-03).

US Patent Application filed 2/6/2008,titled 'Introgression of Festuca Mairie Drought Tolerant Genome into Lolium Perenne Plants'(TEC2003-0035-02).

US Patent Application filed 2/6/2008,titled 'Composition and Methods for Drought Tolerance'(TEC2003-0035-01).

US Provisional Patent App. Filed 2/27/2008, titled 'Biological Synthesis of Poly-3-Hydroxypentanoic Acid'(TEC2006-0146-01Prov).

In addition, 8 patents were issued during this period:

Australian Patent No. 2002-364222 issued 11/1/2007, titled 'Plant Cyclopropane Fatty Acid Synthase Genes and Proteins and Uses Thereof'(TEC2002-0020-02AU).

US Patent No. 7,405,345 issued 7/29/2008, titled 'Novel Gene Sequence(Seed Promoters)'(TEC2000-0006-01DIV1).

Japanese Patent No. 4,068,964 issued 01/18/2008, titled 'Method of Synthesizing Uridine 5'-phosphosulfoquinovose Using a Recombinant Arabidopsis Thaliana Enzyme'(TEC2000-0084-01JP).

US Patent No. 7,241,935 issued 7/10/2007, titled 'Expression of Betaine Lipid Genes in Bacteria and Plants.'

US Patent No. 7,317,098, issued 1/8/2008, titled 'Ryegrass CBF3 Gene: Identification and Isolation'(TEC2004-0055-01).

US Patent No. 7,390,825 issued 6/24/2008, titled 'Process for the Preparation of Oxazolidinones and Method and Use Thereof'(TEC2002-0026-01).

Indian Patent No. 212798 issued 12/17/2007, titled 'Process for the Preparation of an Aldonic-5-Oxime Methyl Ester of a Hexose Sugar'(TEC2000-0060-01IN).

Japanese Patent No. 4060079 issued 12/28/2007, titled 'Process for the Preparation of a 1,5-Dideoxy-1,5-Imino Hexitols from Oximes and Imines'(TEC2000-006-01JP).

3. Publications (Standard General Output Measure)**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan	7	30	
2008	0	75	75

V(F). State Defined Outputs**Output Target**

Output #1**Output Measure**

- Number of research projects on plant sciences.

Year	Target	Actual
2008	35	83

Output #2**Output Measure**

- Number of adult participants trained in plant management systems.

Year	Target	Actual
2008	3996	12901

Output #3**Output Measure**

- Number of youth participants trained in plant management systems.

Year	Target	Actual
2008	1717	6107

Output #4**Output Measure**

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

Year	Target	Actual
2008	1332	1736

Output #5**Output Measure**

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

Year	Target	Actual
2008	2664	1680

Output #6**Output Measure**

- Number of native american adults trained in small scale sustainable agriculture.

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 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 strategies for crops that meet USDA certified organic standards.
5	Number of research programs to develop cultural and management strategies for crops that meet USDA certified organic standards.
6	Number of research programs to develop biological controls for pest insects and diseases to minimize any effects on the environment.
7	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.
8	Number of research programs to identify and isolate novel genes, enzymes and other phytochemicals that may have benefits for human health.
9	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.
10	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.
11	Number of research programs to develop improved varieties of economically important crops for Michigan and the region.
12	Number of variety trials for crops important to Michigan, including wheat, corn, soybeans and forages.
13	Number of adult participants with increased knowledge of plant management systems.
14	Number of native american adults with increased knowledge in sustainable agriculture.
15	Number of research programs to develop production protocols and environmental and cultural strategies for the floriculture/nursery industry.
16	Number of research programs to develop weed control methodology, protocols and practices.
17	Number of research programs to identify plant genome, genetics and genetic mechanisms to improve crops economically important to Michigan and the region.
18	Number of research programs to develop controls for pathogens and nematodes affecting plants.
19	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.

2. Associated Institution Types

•1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	1459	5435

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

One example, increasing demands from schools and parents have come to MSUE for youth gardening programming in the Genesee county community that would be during school, after school and in vocational training programs.

What has been done

The need has led to a sustained involvement by MSUE Hort staff and volunteers in the area of youth gardening education, through our Junior Master Gardener program, our Grow Labs in numerous schools in the community, and training and mentoring of teens in the Amistad Horticulture Program at the Broome Center in Flint - a human services resource center serving underprivileged populations.

Results

The youth were in a landscaping job training program. 89% of the youth reported they would use their newly developed skills in the future.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development
205	Plant Management Systems

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	Quantitative Target	Actual
2008	1132	1476

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The Federal Clean Water Act states, roughly, 'keep manure and associated nutrients and pathogens out of surface waters'. The MDA Right to Farm Guidelines establish a list of recommend management practices to accomplish this along with decreasing odor from manures. The big farms are expanding. New farms are being established in areas unaccustom to livestock. Rural housing is not going to decrease. The non farm public is educated, aware and watching. Animal agriculture is astute enough to know that what was okay when there were 20 50 head of livestock is not sufficient when there are 200 or 2000 or 5000 head of livestock. The new DEQ permit system and USDA/NRCS cost share funds will now require a higher standard of conformance and a greater ability to document farming operations. Although the basic management practices necessary to accomplish the task are not terribly new, the urgency is greater, the learning curve steep and the teachable moment almost necessitates MSU Extension's ability to meet the educational need of improved nutrient, conservation and farmstead management. Extension agents, mostly through the Manure, Crops, Dairy and Livestock AOE's, need to sharpen their skills in manure nutrient management. They also need to be current on the new permit system and the Michigan Ag Environmental Assurance Program option for farms to become environmentally assured.

What has been done

MSUE developed educational programs that included information on regulatory issues and or the Michigan Ag Environmental Assurance Program. The recommendations and suggestions for improved manure management were also used in concert with the regulatory agencies, so there were not mixed messages about best management practices being delivered to producers.

Results

Approximately 85% of the participants gained knowledge in regulatory and best practices in this area.

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	Quantitative Target	Actual
2008	2264	1680

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Michigan producers are faced with pest management decisions during the growing season. Having proper scouting and control methods can enhance profitability.

What has been done

Crop producers and agri businesses throughout Michigan the target audience. Meetings were held in 10 locations in early January through February. Geographically, the meetings reached from Cass County to Presque Isle County. In addition, a meeting targeting agri business professionals and farmers was held in December in East Lansing.

Results

From those that were surveyed, more than 80% of growers attending a training indicated that they would use information learned to make management decisions, including pest management decisions. Over 50% felt that the decisions would earn or save them money in the upcoming growing season. Growers expected to save \$151,100 over 11,450 acres or an average of about \$13.20/acre.

4. Associated Knowledge Areas

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

Outcome #4**1. Outcome Measures**

Number of research programs to develop insect and disease control strategies for crops that meet USDA certified organic standards.

Not reporting on this Outcome for this Annual Report

Outcome #5**1. Outcome Measures**

Number of research programs to develop cultural and management strategies for crops that meet USDA certified organic standards.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	2	2

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The number of certified organic farms and the acres of farmland in certified organic production in the U.S. more than double from 1992 to 1995. In 2005, just over 8,000 U.S. farmers had more than 4 million acres in certified organic production. Michigan has 230 organic farmers and just under 50,000 certified organic acres. As this only represents about .45 percent of total acreage in Michigan, additional ways to increase production and marketing efficiencies is important if organic growers are to remain economically viable. Further, to ensure organic growers continue to be a contributor to this \$10 billion market, they need pest control methods that conform to organic standards and allow them to produce plentiful, pest-free crops.

What has been done

Passive solar greenhouses (PSGH) were built on farms in three locations where farmers in the study were already selling produce at the same farmers' market in each location. The objective was to measure the economic impact of season extension on farm income and the farmers' market when three local farms can provide extended season production. Yield data were also collected for a similar passive greenhouse located on an organic teaching farm/

Results

Year-round certified organic production of diversified vegetables, herbs and flowers continued in five passive solar greenhouses or hightunnels totaling 12,000 square feet of covered area. Market demand for extended season produce was high. Eight, two-hour farm walks were held at the MSU Student Organic Farm. Twelve additional PSGH workshops ranging from two to six hours in length were offered at nine locations in Michigan. Copies of PSGH educational materials were provided to at least 500 workshop participants.

After five years of surveying native bee populations, the first comprehensive survey of native bee populations in the state's blueberry crop was completed -- more than 170 species were identified.

To help attract and keep native bees in blueberry fields, researchers are using native plants and more. They've placed nesting boxes in fields and are making sure there are areas of open soil near the native plants so ground-nesting bees have a desirable place to live. They're also investigating how landscape features such as unmown ditches and natural areas influence native bee populations.

In a greenhouse research study, organic tomato transplants were produced in a sphagnum peat and compost root medium amended with an alfalfa and animal protein based organic-approved fertilizer at five rates of incorporation and five pre-plant root medium incubation times. Rates of 1, 2, 3.5 and 5% by volume provided acceptable tomato transplants at six weeks after sowing with a trend of increased growth with increased rate of amendment.

4. Associated Knowledge Areas

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

Outcome #6

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	Quantitative Target	Actual
2008	3	8

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 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 or diseases on honey bees to achieve better control of pests and diseases and to gain increased honey production and more effective pollination of agricultural crops; and to develop biological and cultural tactics based on vegetation management.

Results

Resistance to Imidacloprid in Michigan commercial potato fields has increased in number of locations affected and levels of resistance since 2007. In 2008, 90% of the Michigan fields tested showed greater than 10-fold resistance to Imidacloprid compared to 67% in 2007.

The fundamental equation researchers discovered to explain the mating disruption kinetics of codling moths has been disseminated at national and international scientific meetings and is expected to guide all future mating disruption research and applications.

MSU IPM, specialists, consultants, MSU Extension and commodity groups provided key recommendations on integrated pest management tactics that were adopted by USDA conservation programs in Michigan. A key result has been an increase in financial assistance to growers to implement IPM through the USDA's Environmental Quality Incentives Program.

Mite Zapper LLC (Detroit, MI) and MAES researchers further refined a mite control device for honey bee colonies. The product should be on the market May/June 2009.

Ovavesicula popilliae, a pathogen that helps suppress the Japanese beetle, is now well established around Battle Creek and Kalamazoo, and at 3 golf courses in southeast Michigan. Over 330 people from 20 different counties in Michigan have attended beetle biocontrol field days to learn about the program and help release *O. popilliae*.

4. Associated Knowledge Areas

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

Outcome #7**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 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	5	5

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.

What has been done

Research to decrease reliance on conventional crop protection practices by utilizing low environmental impact fungicides in combination with host resistance; increase the environmental and economic sustainability of small fruit production in Michigan by integrating various disease control options and strategies; and to collaborate on innovative orchard management strategies and technologies.

Results

Two new diseases of blueberries, *Cylindrocladium* spot/blight and *Pseudomonas* blight were identified in 2008.

Field studies of regular and biofungicides against mummy berry showed very good control by Serenade +Nufilm (a surfactant). In grapes, dormant sprays of Cuprofix significantly reduced black rot. Fungicide efficacy trials showed that Stylet Oil, Sulforix, and Kaligreen were among the most effective in eradicating powdery mildew. Numerous organic fungicides were tested against black rot, Phomopsis, and downy mildew - the most effective were Serenade + NuFilm and Sonata + Nufilm. A trial assessing performance of biological control agents, leaf removal and fungicide against sour rot and other bunch rots in grapes, showed that leaf removal was a good strategy to control bunch rots.

Research combining host plant resistance with managed fungicide applications to control potato late blight resulted in a reduction of fungicide input while still achieving significant control in varieties with moderate late blight susceptibility.

Research findings resulted in revising Michigan's corn nitrogen recommendations. Results of delayed-release nitrogen fertilizer effects on Michigan sugarbeet production will be presented at the Annual Michigan/Ontario Research Reporting Session in January 2009.

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

Outcome #8

1. Outcome Measures

Number of research programs to identify and isolate novel genes, enzymes and other phytochemicals that may have benefits for human health.

Not reporting on this Outcome for this Annual Report

Outcome #9

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	Quantitative Target	Actual
2008	5	23

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. While 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 sources of genes that can be used for variety improvement. Further, current transformation techniques are not applicable to all plant species.

What has been done

Research to develop a novel transformation system that is suitable for large seeded legumes; exploring ways to increase the amount of plant oil that can be produced and extracted from the seeds and tissues of certain crops; breed new varieties of blueberry, strawberry and sour cherry cultivars for Michigan that are resistant to a common array of biotic and abiotic stresses; better understand breeding and genetics for improvement of soybean and potato for food value, yield and pest resistance; and determine how to enhance resistance to plant invaders.

Results

Several oat varieties yielded over 130 bushels, including several promising lines (MSU 4002-6 and MSU 4009-2-5-1).

A new northern highbush blueberry cultivar known as Huron (MSU 47) was released - a productive, early ripening cultivar with very high fresh market quality and a long storage life.

The MSU potato breeding and genetics program continues to produce new germplasm and advanced seedlings that are improved for cold chipping, and resistance to scab, late blight and Colorado potato beetle. Twelve promising new chip processing lines were identified in 2008.

Research results showed that high tunnel environments double or triple raspberry yields compared to field plantings, increase berry size, and reduce berry rot by 70-80%.

For the first time, the relationship of cultivated rice and its wild relatives with the same number of chromosomes has been resolved. Progress continues toward identifying genes underlying important phenotypic traits influencing the survival of wild rice species in variable environments and potentially contributing to rice improvement.

A germplasm trial to test response in cucumbers to downy mildew was performed at the MSU Muck Farm. Although no cultivars were fully resistant, there were clear differences in degree of susceptibility, which may inform cultivar selection for growers.

The aphid resistance genes in two plant introductions (PI 567541B and PI 567598B) were found to negatively interfere with the reproduction of the aphid and thus control the insect effectively. This information will be useful to breeders for designing efficient breeding schemes for developing soybean cultivars with antibiosis resistance to aphids.

4. Associated Knowledge Areas

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

Outcome #10

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	Quantitative Target	Actual
2008	3	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 move them from one plant to another.

What has been done

Research to determine foliage thresholds based on the assimilation and storage of carbon; test remote sensing techniques and stress response detection; understand the genetic mechanisms by which plants tolerate environmental stresses; determine how to enhance resistance to plant invaders; and examine plant-microbe interactions.

Results

Researchers recently described a regulatory network in Arabidopsis, the CBF cold-response pathway, that has a fundamental role in cold acclimation. The pathway includes activator proteins that act as master switches to induce expression of a set of genes that enhances Arabidopsis freezing tolerance and an increase in drought and high salinity tolerance. Efforts are underway to determine whether these CBF genes can be used to improve the abiotic stress tolerance of agronomic plants. Results have been encouraging. Findings show that overexpression of CBF genes in canola increases plant freezing tolerance and overexpression of CBF genes in rice and wheat improves drought tolerance.

Transgenic plants expressing a CBF gene from Arabidopsis, tomato and wild relative species of the cultivated *Petunia hybrida* were analyzed related to cold acclimation in the genus. Interspecific hybrid populations among *Petunia* species were developed to allow genetic mapping and development of molecular markers for traits of interest.

4. Associated Knowledge Areas

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

Outcome #11**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	Quantitative Target	Actual
2008	6	18

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Agriculture is one of Michigan's top three industries. The state's agrifood system accounts for \$71.3 billion in total economic activity and more than 1 million jobs. Michigan is also one of the most diverse agricultural industries in the U.S. from field crops to fruits and horticultural crops. 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. Developing improved crop varieties is an important part of sustaining an economically viable agriculture industry.

What has been done

Research to test new strategies for sustainable vegetable production; develop management practices for improving grain yield and profitability in corn and soybean production systems; characterize and identify genes responsible for conferring mutant phenotypes during fruit development and ripening of tomato; determine the biochemical mechanisms that cause self-incompatibility in sweet cherry; and develop a data driven protocol for culture of juice grape cultivars (Concord and Niagara) in Michigan that will produce maximum annual sustainable yields under highly variable annual growing conditions.

Results

Studies with brassica cover crops (biofumigants) increased celery and onion yields by 8-15% on muck soils. Oilseed radish and yellow mustard also improved onion stand establishment by 38-43%. Therefore, growers could reduce their onion seeding rates by up to 40% with no yield loss if appropriate cover crops and management practices are used.

Mapping populations have been generated for several mutant loci that impact fruit quality in tomato and phenotypic evaluation of mutations that alter fruit quality have been initiated. A diverse collection of Solanaceae germplasm has been assembled for metabolite profiling.

Zorro, a new black bean variety was released. Zorro has a combination of favorable characteristics including an upright architecture, high yield, improved levels of resistance to common bacterial blight and rust, and excellent canning quality. Along with Zorro, two additional varieties will be released in 2009 - Santa Fe, a pinto, and Fuji, a Tebo bean variety. Santa Fe has tolerance to white mold and has an excellent yield and upright architecture. Fuji has resistance to viral resistance and is suitable for export markets for use in sweet bean paste.

In addition to confirming the expression of known genes, researchers have identified over 15 candidate genes of unknown function that are strong candidates for involvement in hemicellulose biosynthesis.

Two new routes to biofuel components have been developed and are currently being produced and tested in small quantities. A fifty-liter reactor for the production of test quantities of biofuels has been put in place to allow for engine tests on the MSU campus.

Studies indicate that key changes conferring resistance to *Phytophthora capsici* occur in the cucumber surface at approximately 10-12 days post pollination. Several other cucurbit crops including zucchini, yellow summer squash, pumpkin, butternut squash, melon and watermelon were also tested for age-related resistance to *P. capsici*. Zucchini and yellow summer squash were most susceptible overall. All of the crops exhibited age-related decrease in susceptibility, but to varying degrees. Cucumber had the most pronounced effect.

A germplasm trial to test response to downy mildew in cucumber was performed at the MSU Muck Farm. Although no cultivars were fully resistant, there were clear differences in degree of susceptibility, which may inform cultivar selection for growers.

4. Associated Knowledge Areas

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

Outcome #12

1. Outcome Measures

Number of variety trials for crops important to Michigan, including wheat, corn, soybeans and forages.

Not reporting on this Outcome for this Annual Report

Outcome #13

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	Quantitative Target	Actual
2008	3397	10966

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

One example, nitrogen, phosphorus and potassium fertilizer prices have increased dramatically in the past two years. In addition to high prices, demand for these materials may be so high that adequate supplies may not be available. The statewide advisory committee for the Field Crops AoE team met in March of 2007 to identify and prioritize their educational needs. Soil fertility and nutrient management was identified as their highest priority educational need. Educators also gathered input from key producers regarding their educational needs and incorporated this into the agenda.

What has been done

MSUE developed and conducted two-day programs in Lawrence and Frankenmuth in late February 2008.

Results

Over 150 farmers and agronomists participated in the programs. According to the written evaluations, 92% of the participants learned new information from the program. 77% plan to use the information they learned to make management decisions in 2008. 61% expect the information they plan to implement will save or earn them additional money in 2008. The average amount of money they plan to earn or save per acre is \$17.56. Since the participants indicated they plan to implement the new information on 78,943 acres, the projected financial impact of this educational activity is \$1,372,618.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #14**1. Outcome Measures**

Number of native american adults with increased knowledge in sustainable agriculture.

Not reporting on this Outcome for this Annual Report

Outcome #15**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	Quantitative Target	Actual
2008	{No Data Entered}	7

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The wholesale value of floriculture crops produced in Michigan is more than \$370 million annually. There are almost 700 floriculture companies in Michigan, with over half of them reporting wholesale sales of more than \$100,000. Total greenhouse cover is 48.2 million square feet with an additional 3,620 acres of open ground used for floriculture production.

What has been done

Research to evaluate turfgrass species and mixes for their adaptation to athletic field turf and to assess the effects of cultural practices; investigate nitrogen fate in turfgrass; develop protocols that growers and retailers can use to produce and profitably sell perennials as new floriculture crops; promote the use of less utilized eastern hardwood species for interior and exterior applications where biological and physical deterioration is a limiting factor for their utilization; and evaluate several perennial semi-aquatic or aquatic plants for use in the phytoremediation of nursery runoff water.

Results

Findings show that the turf sod/soil interface can be improved by pre-harvest cultivation of sod; robotic mowing can reduce labor costs and increase turfgrass density; and aggressive topdressing with high sand content materials on native soil athletic fields combined with tile drainage can improve event capacities of sports fields at significant cost savings to school and municipalities.

A process that takes abundant low-value wood from underutilized hardwood species was developed. The wood is heat treated to improve its dimensional stability or pressure treated with relatively low cost and environmentally friendly chemicals to increase its resistance to biological and physical degradation and improve its aesthetic appearance.

Fir, spruce and white pine trees in 3-gallon containers receiving 4-cyclic pulses of irrigation per day grew more than trees that were given the same amount of irrigation but delivered only once per day. Caliper growth of the maple, oak, honeylocust and elm trees grown in the 7-gallon containers showed a strong interaction between daily irrigation rate and irrigation frequency. Trees receiving the low rate of irrigation grew more when watered once per day. Trees at the high level of irrigation grew more when irrigation was applied on 4 cycles per day.

4. Associated Knowledge Areas

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

Outcome #16**1. Outcome Measures**

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

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	{No Data Entered}	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 also may 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 the North Central Region. It is estimated that losses due to weeds left uncontrolled exceed \$7.5 billion annually in the U.S.

What has been done

Research to determine the mode of action, basis for selectivity and fate of new or potentially new herbicides for weed control in agronomic crops in Michigan; define management strategies that address shifts in weed populations; and identify effective and safe herbicides for weed control in fruit, vegetable and ornamental crops.

Results

Field research conducted to determine the influence of total inorganic soil nitrogen on the germination, emergence, and growth of five weed species showed that emergence of common lambsquarters increased as nitrogen application rate increased for each application date in one of two years, and weed biomass was greater at four of six nitrogen application dates, when 112 kg of nitrogen per hectare was applied.

Onion is a poor competitor and requires season-long weed control to obtain maximum yield. Experiments were conducted in 2008 to develop usage patterns for several newly formulated and labeled onion herbicides. When the herbicide flumioxazin was applied at the 2 and 4 leaf stage, there was no significant injury or yield loss in any of the cultivars, regardless of the rate of flumioxazin applied. Other herbicides tested resulted in significant reductions in onion height, leaf number, and yield among all cultivars.

4. Associated Knowledge Areas

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

Outcome #17**1. Outcome Measures**

Number of research programs to identify plant genome, genetics and genetic mechanisms to improve crops economically important to Michigan and the region.

Not reporting on this Outcome for this Annual Report

Outcome #18**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	Quantitative Target	Actual
2008	{No Data Entered}	6

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Nematodes are among the parasites that attack numerous economically important plants reducing their yield potential substantially by destroying the root system of plants. 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 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; examine methods and problems associated with controlling disease in agriculture; and design and develop integrated management strategies for plant-parasitic nematodes that include consideration of environment and genetic variability.

Results

A Fertilizer Use Efficiency (FUE) model was developed that recognizes variable responses and identifies four categories of interactions necessary for integrated management decision-making options that account for agronomic, economic, ecological and environmental and pest management issues. Researchers have also modified the FUE model to identify and monitor changes in soil conditions. Results have been disseminated to stakeholders and the scientific community at regional, national and international conferences and symposia.

A reduced-risk, orchard pest replacement and organic pest management strategy for Upper Midwest tree fruit and row crops was developed for control of key orchard pests including plum curculio, codling moth, cherry fruit fly, apple maggot, oblique banded leafroller, lesser and greater peach tree borers and American plum borer.

4. Associated Knowledge Areas

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

Outcome #19**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 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	{No Data Entered}	3

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% to as high as 40%.

What has been done

Research to elaborate temperature-dependent models for packaging of horticultural products in perforated and non-perforated packaging film materials and evaluate the impact of the differences in atmosphere on product quality; evaluate postharvest requirements of new and existing fruit varieties; develop fruit plant canopies and management systems that fit to advances in computer and mechanical technology to achieve maximum efficiency and sustainable practices that conserve energy and resources in producing quality fruit.

Results

Advances in vineyard technology make a job that previously took up to 40 hours per acre can now be completed in one-fourth of the time. Researchers have developed a mechanical pruner and a cane positioner designed to move canes more effectively into position for the mechanical pruner. In addition to making grapes a better target for the mechanical pruner, studies show that correct positioning can increase p fruit maturity and result in better fruit quality with higher soluble solids.

Research to determine the impact of controlled atmosphere storage conditions on Honeycrisp apples showed that as much as 70% of the fruit from individual lots suffered mild to extreme internal browning under low oxygen (1% and 3%) and carbon dioxide (3%) levels. When the oxygen level was increased to that of air (21%), internal browning occurred only when the carbon dioxide was present - although the degree of damage was relatively minor. Preliminary work has been shared with apple growers and storage operators in the state.

4. Associated Knowledge Areas

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

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

We continue to review and refine planned program and outcome measure reporting in this report., hence the significant number of outcomes marked, "Not reporting on this outcome measure." In moving from five planned programs to six, some projects were moved into different planned programs than they were previously reported. In other instances, outcome measures were folded in to broader outcome measure categories to make reporting easier and more consistent. Further, the targets in this report (as they were in the previous year's report) compared to actuals aren't necessarily due to unmet goals, but rather a reconfiguration of goal associations and knowledge areas.

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- After Only (post program)
- Retrospective (post program)
- Before-After (before and after program)
- Case Study
- Comparisons between program participants (individuals,group,organizations) and non-participants
- Comparison between locales where the program operates and sites without program intervention

Evaluation Results

Key Items of Evaluation

Program #4

V(A). Planned Program (Summary)

1. Name of the Planned Program

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

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
401	Structures, Facilities, and General Purpose Farm Supplies	3%		3%	
402	Engineering Systems and Equipment	6%		6%	
403	Waste Disposal, Recycling, and Reuse	6%		14%	
404	Instrumentation and Control Systems	11%		9%	
501	New and Improved Food Processing Technologies	18%		14%	
502	New and Improved Food Products	17%		15%	
503	Quality Maintenance in Storing and Marketing Food Products	18%		18%	
511	New and Improved Non-Food Products and Processes	16%		16%	
512	Quality Maintenance in Storing and Marketing Non-Food Products	5%		5%	
Total		100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	9.0	0.0
Actual	0.4	0.0	9.0	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
18985	0	994690	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
18985	0	836292	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	4789980	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research 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 new biobased economic sector.

Identify breeding and genetic improvement related to food quality, nutrition and processing.

Develop packaging systems to enhance food quality and shelf life.

Develop the processes and technologies to manufacture functional foods.

Develop new biosensors and DNA chips that can rapidly and accurately detect a broad spectrum of harmful organisms in food and water, such as *E. coli*, *Salmonella*, *Listeria*, *Campylobacter*, *Cryptosporidium* and *Giardia*. Train native american adults on energy crops and renewable resources.

2. Brief description of the target audience

Agriculture and natural resources industry representatives, biotechnology company representatives, state agency representatives, private citizens, entrepreneurs. Native american growers.

V(E). Planned Program (Outputs)**1. Standard output measures****Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	0	0	0	0
2008	0	0	0	0

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

Year **Target**

Plan: 6

2008 : 6

Patents listed

US Patent App filed 3/3/08 titled 'Conductimetric Biosensor Device, Method and System' TEC2002-0018).

US Patent App filed 6/19/08 titled 'Nanoporous Silicon-Based Electrochemical Nucleic Acid Biosensor'(TEC2005-0068).

US Patent App filed 6/18/2008 titled 'Electrically-Active Gerromagnetic Particle Conductimetric Biosenor Test Kit' (TEC2007-0036).

U.S. Patent filed 6/18/2008, titled 'Biologically Enhanced Electrically Magnetic Nanoparticles for Concentrating, Separating and Biosensing Applications' (TE2007-0157).

Provisional Patent filed 8/31/2007, titled 'JY-1 Regulation of Granulosa Cell Function and Early Embryonic Development in Cattle' (TEC2003-0053-02Prov).

Provisional Patent App. filed 7/19/2007, titled 'Methods and Compositions to Enhance Efficiency of Nuclear Transfer/Cloning' (TEC2007-0089-01Prov).

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan	0	27	
2008	0	26	26

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research projects focusing on food quality, nutrition, engineering and processing.

Year	Target	Actual
2008	27	23

Output #2

Output Measure

- Number of adults trained on new and improved non-food and bioeconomy related products and processes.

Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of native american adults trained in energy crops and renewable resources.

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 research programs to develop new processes to break down cellulose from plant biomass into fermentable sugars.
2	Number of research programs to develop and evaluate a continuous production process to create biodiesel from plant-based oil.
3	Number of research programs to help Michigan-based biodiesel companies create business plans and begin production.
4	Number of research programs to develop new processes and technologies to create succinic acid and other platform chemicals from renewable biomass sources.
5	Number of research programs to create a biorefinery for testing concepts, developing applications, creating prototypes for the bioproducts industry, training the growing work force, and spurring innovation and engineering of next generation bioproducts equipment and technologies.
6	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 new biobased economic sector.
7	Number of research programs to identify and isolate beneficial plant compounds that can be used to make new functional foods.
8	Number of research programs to develop the processes and technologies to manufacture functional foods.
9	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, Cryptosporidium and
10	Number of adults with new and improved knowledge on non-food and bioeconomy related products and processes.
11	Number of native american adults with improved knowledge on energy crops and renewable resrouces.
12	Number of research programs to identify breeding and genetic improvement related to food quality, nutrition and processing.
13	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 develop new processes to break down cellulose from plant biomass into fermentable sugars.
Not reporting on this Outcome for this Annual Report

Outcome #2

1. Outcome Measures

Number of research programs to develop and evaluate a continuous production process to create biodiesel from plant-based oil.
Not reporting on this Outcome for this Annual Report

Outcome #3

1. Outcome Measures

Number of research programs to help Michigan-based biodiesel companies create business plans and begin production.
Not reporting on this Outcome for this Annual Report

Outcome #4

1. Outcome Measures

Number of research programs to develop new processes and technologies to create succinic acid and other platform chemicals from renewable biomass sources.
Not reporting on this Outcome for this Annual Report

Outcome #5

1. Outcome Measures

Number of research programs to create a biorefinery for testing concepts, developing applications, creating prototypes for the bioproducts industry, training the growing work force, and spurring innovation and engineering of next generation bioproducts equipment and technologies.
Not reporting on this Outcome for this Annual Report

Outcome #6

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 new biobased economic sector.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	10	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Michigan, along with many other states, is struggling to revitalize 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 help boost the state's economy.

What has been done

MAES scientists from various disciplines (e.g., basic sciences, engineering, packaging, plant sciences) are all working to enhance Michigan's economy and environment by providing critical information and developing new processes and technologies to create new products from plants and other renewable resources.

Results

Canola is one of the world's most oil-dense crops. MAES scientists believe canola has the potential to play a dominant role in unclenching the grip that imported petroleum fuels have on Michigan, as well as offering growers new markets for a high-value crop. In 2008, 200 acres of canola were planted by farmers and crushing and biodiesel processing facilities were established at the MSU Biorefinery Training Facility. The crusher can smash 1 ton of seeds per day, enough for about 100 gallons of biodiesel. The first year of research demonstrated that canola could be grown, processed and made into biodiesel with a profit return for farmers. For 2009, researchers hope to have 600 acres of canola planted for research purposes.

4. Associated Knowledge Areas

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

Outcome #7**1. Outcome Measures**

Number of research programs to identify and isolate beneficial plant compounds that can be used to make new functional foods.

Not reporting on this Outcome for this Annual Report

Outcome #8**1. Outcome Measures**

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

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	3	8

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.

What has been done

Research to develop improved methods for the design and operation of thermal processing systems for protein foods; develop food-grade specialty soybean varieties for Michigan; increase the nutritional composition of nutraceuticals; evaluate the efficacy of processes and ingredients that impact known safety hazards in muscle foods; identify, develop and/or apply postharvest technology to support the Michigan fruit, vegetable and chestnut industries; and develop technologies to support management systems for quality grains and oilseeds; and demonstrate that incorporation of germinated soybean powder into cow milk yogurt will produce increased yield of biologically active compounds to meet recommended requirements for added health claims.

Results

A previously-developed model to analyze the effect of prior sublethal thermal history on subsequent inactivation rates was tested in laboratory and pilot-scale cooking trials with inoculated, whole-muscle beef and turkey roasts. To date, testing has quantified the efficacy of low-energy x-ray irradiation for pasteurization of ground beef patties, almonds, and leafy greens.

Evaluation of insect infested and non-infested tart cherries using reflectance and transmittance spectroscopy was expanded. Results indicated cherries could be correctly classified with approximately 90% accuracy.

A dimensional analysis model has been developed to quantify transfer events of *E. coli* O157:H7. A simplified version of the model is being used to quantify the aggregate rates of transfer for a complete process. Initial results show that ~92% of the *E. coli* O157:H7 inoculum on the product is transferred to various components of the processing line.

Blends of reconstituted non-fat dry milk and germinated soy products were used to make low-fat Swiss-style strawberry yogurt. Sensory evaluation by 112 untrained panelists showed that there was no consumer preference for cow's milk yogurt over whole soy-fortified cow's milk yogurt. Analysis of yogurt samples showed that total isoflavone contents increased from 1st to 6th week of cold storage.

4. Associated Knowledge Areas

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

Outcome #9**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*, *Cryptosporidium* and

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	3	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 76 million food-borne illnesses occur each year in the United States, accounting for 325,000 hospitalizations and 5000 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

Significant research has been undertaken to develop biosensor technologies and rapid identification systems to assure food supply chain security, quality and safety.

Results

A nanoparticle-tracer based bio-barcode DNA biosensor and a 'green' method of biologically synthesizing gold nanoparticles and gold nanowires for biosensor applications (versus the standard chemical method) were developed in 2008. Work has begun on developing a multi-drug resistant tuberculosis biosensor to determine whether a person is infected with Mycobacterium tuberculosis and if the MTB is multi-drug resistant. If resistance can be identified, a medical doctor can better determine the best course of treatment.

4. Associated Knowledge Areas

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

Outcome #10**1. Outcome Measures**

Number of adults with new and improved knowledge on non-food and bioeconomy related products and processes.

Not reporting on this Outcome for this Annual Report

Outcome #11**1. Outcome Measures**

Number of native american adults with improved knowledge on energy crops and renewable resources.

Not reporting on this Outcome for this Annual Report

Outcome #12**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	Quantitative Target	Actual
2008	{No Data Entered}	8

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 discover health-beneficial constituents and new and more effective ways to develop improved yield, quality and disease resistance through the study of breeding and genetic improvement.

Results

Biochemical studies on flour proteins of targeted wheats showed that a stronger protein flour was more desirable for crackers than for cakes and cookies. A bench-scale method developed for evaluation of cooked noodle texture showed that the procedure could discriminate among wheat flours on the basis of their noodle-making properties.

New mechanistic data on how foodborne ribotoxic chemicals act and how their toxicity can be prevented was identified. Findings were disseminated in presentations at the Society of Toxicology, National Fusarium Head Scab and the Michigan Society of Toxicology annual meetings.

As the effective cancer treatment drug Taxol enters its next generation, research continues on finding a way to manufacture more potent Taxol molecules that could potentially reduce treatment dosages. Researchers are looking for alternative, biological routes to introduce the modifications. The targets are five enzymes that biosynthetically decorate the core of the Taxol molecule. Results of these findings were presented at Washington State University, the Institute of Biological Chemistry, Tianjin University and the 7th U.S.-Japan Natural Products Conference in 2008.

Research demonstrated that Dps regulates DnaA function and reduces initiations to act as a checkpoint during oxidative stress, providing an opportunity for mechanisms to repair oxidative DNA damage.

4. Associated Knowledge Areas

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

Outcome #13**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 Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	{No Data Entered}	2

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 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

This packaging system research addresses safety improvement of fresh and fresh-cut fruits and vegetables by applying a standard chlorine wash couples with a packaging system that uses chlorine dioxide gas to significantly reduce E. coli and Salmonella. For reusable packaging, researchers are comparing bio-based and petroleum-based plastics for fresh cut fruits and vegetables and evaluating the quality of fresh mangoes in different shipping containers to help develop a standard shipping container that can be used to maintain high quality fruit from various countries.

Results

DuPont Biomax and Sorona are two of many newly developed biopolymers which are gaining a lot of attention in packaging industry. Evaluation of the moisture sorption of these two biodegradable polymer films and resins showed that the moisture uptake by Biomax sheets was five times as that of the Sorona sheets.

Research on the performance requirements of reusable plastic containers (RPCs) found them to have significantly higher strength and pre-cooling and temperature control performance. Also, unlike paper-based containers, plastic containers are not significantly affected by moisture or water and provide product protection during the entire distribution and retail display cycle. These advantages have led to an increase in the use of RPCs for fresh produce. The estimated cost of using expendable corrugated containers exceeds \$7 billion annually in the U.S. Use of a reusable package system would greatly reduce costs associated with packaging and address environmental issues.

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

Brief Explanation

We continue to review and refine planned program and outcome measure reporting in this report., hence the significant number of outcomes marked, "Not reporting on this outcome measure." In moving from five planned programs to six, some projects were moved into different planned programs than they were previously reported. In other instances, outcome measures were folded in to broader outcome measure categories to make reporting easier and more consistent. Further, the targets in this report (as they were in the previous year's report) compared to actuals aren't necessarily due to unmet goals, but rather a reconfiguration of goal associations and knowledge areas.

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- After Only (post program)
- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Case Study
- Comparisons between program participants (individuals, group, organizations) and non-participants
- Comparison between locales where the program operates and sites without program intervention

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

Program #5

V(A). Planned Program (Summary)

1. Name of the Planned Program

Economics, Marketing and Policy

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management	20%		20%	
602	Business Management, Finance, and Taxation	12%		10%	
603	Market Economics	3%		3%	
604	Marketing and Distribution Practices	5%		5%	
605	Natural Resource and Environmental Economics	22%		20%	
606	International Trade and Development	3%		7%	
608	Community Resource Planning and Development	26%		20%	
609	Economic Theory and Methods	3%		5%	
610	Domestic Policy Analysis	5%		9%	
611	Foreign Policy and Programs	1%		1%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	27.0	0.0	11.0	0.0
Actual	37.2	0.0	10.0	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
1665651	0	1013637	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1665651	0	852221	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	4881218	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and Extension activities 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.

Identify and evaluate human resources management practices in Michigan agricultural and green industries.

Develop a framework to understand and analyze domestic and international trade policies and assess their impact on Michigan.

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.

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; local, state and federal elected officials.

V(E). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons (contacts) reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	4717	9434	0	0
2008	6512	13024	0	0

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

Patent Applications Submitted

Year Target

Plan: 1

2008 : 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

	Extension	Research	Total
Plan	5	25	
2008	0	27	27

V(F). State Defined Outputs**Output Target****Output #1****Output Measure**

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

Year	Target	Actual
2008	21	28

Output #2**Output Measure**

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

Year	Target	Actual
2008	861	1114

Output #3**Output Measure**

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

Year	Target	Actual
2008	1734	1593

Output #4**Output Measure**

- Number of adult participants trained in natural resource and environmental economics.

Year	Target	Actual
2008	512	1598

Output #5**Output Measure**

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

Year	Target	Actual
2008	1610	2206

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O No.	OUTCOME NAME
1	Number of adult participants trained in economics of agricultural production and farm management.
2	Number of adult participants trained in business management, finance and taxation.
3	Number of adult participants trained in natural resource and environmental economics.
4	Number of adult participants trained 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 of Michigan farm markets, greenhouses and other green industry retailers.
8	Number of research programs to identify and evaluate human resources management practices in Michigan agricultural and green industries.
9	Number of research programs to develop a framework to understand and analyze domestic and international trade policies and assess their impact on Michigan.
10	Number of research programs to evaluate how Michigan citizens use the Internet when searching for information about a vacation destination or planning a vacation.
11	Number of research programs to determine rationale for farmland preservation choices and how changes will affect the Michigan tax base.
12	Number of research programs to develop models to estimate the demand for and value of recreational fisheries and wildlife resources.
13	Number of research programs to identify and evaluate the policy, technology and marketing issues faced by Michigan organic growers and develop responses.
14	Number of research programs to evaluate the competitiveness and marketing strategies and human resource management practices in Michigan agricultural and green industries.

Outcome #1**1. Outcome Measures**

Number of adult participants trained 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	Quantitative Target	Actual
2008	732	1003

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The long-term future of Michigan farms and agribusinesses is dependent upon successful business transitions to the next generations. The goal is to keep the assets and resources of the business in agricultural on a sustainable basis that looks at having good industry information, good farm information, and plans that help the transition of farms from one generation to the next.

What has been done

One example is members of the MSU Extension Farm Management Team met with managers of 254 farm operations during 2008 to help them complete farm business analyses. During the analyses the farm owners generated end-of-year net worth statements and accrual adjusted income statements and learned about many other important financial data pieces and trend information. The total net worth of these farms was \$676,150,000 or \$2.6 million per farm. The MSU Extension Farm Management Team offered farmers instruction in estate planning and business succession.

Results

Team members worked with 253 family members who manage 67 farm businesses during 2008. Those businesses controlled 84,170 acres of land, and by implementing the suggestions team members offered, they will save more than \$25,683,000 or \$383,000 per farm in future estate taxes.

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 trained in business management, finance and taxation.

2. Associated Institution Types

•1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	1474	1354

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

One example, tax management is a high priority that can save producers thousands of dollars. One of the benefits of the TELFARM system for producers is the offering of this educational program to learn of new tax shanges and how to best utilize these law changes to their advantage.

What has been done

'Every Year' is a tax estimate and management session that is part of the MSUE TELFARM program offered every year.

Results

An evaluation of the program found ninety four percent (94%) of attendees utilized the tax estimate and tax management process. The average tax deferral per farm was \$17,782 or \$1,689,260 for all business combined.

4. Associated Knowledge Areas

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

Outcome #3**1. Outcome Measures**

Number of adult participants trained in natural resource and environmental economics.

2. Associated Institution Types

•1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	435	1358

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The Michigan Forage Council and the state Grasslands Forage Specialist for NRCS have identified the need to work with dairy producers to improve their profitability by using natural grasslands.

What has been done

MSUE coordinated with the National Association of County Agricultural Agents National Conference Forage Tour in the Grand Rapids area to deliver educational sessions. The primary objective was to utilize grazing expertise from producers who were willing to share details and economics of their operation with other Extension professionals.

Results

The evaluation showed that 100% of attendees rated an increase in their competency level on the topic of Dairy Grazing and Profitability as strongly agree or agree. 50% of the people attending strongly agreed that the topic was unique to their programming area, 30% agreed and 20% were neutral. When asked if they would apply the information to their programming area, 60% strongly agreed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics

Outcome #4**1. Outcome Measures**

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

2. Associated Institution Types

•1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	1368	1875

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

One example is a request from the Genesee County Land Bank Authority that had over 2000 vacant properties in Flint to help in developing and implementing a green program that would help maintain these properties (due to rising costs and lower property values) and help put them back to productive use.

What has been done

The MSU Extension community and economic development educator worked with 12 community organizations in the Genesee County Land Bank's Clean and Green Program and assisted in revising the program's planning, implementation and evaluation processes. MSUE facilitated several public meetings for input in the planning the use of the vacant lots.

Results

The project reduced maintenance costs by involving a wide range of community partners but also helped to improve neighborhood conditions and stabilizes the neighborhood decline through new programs like Adopt a Lot Program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

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 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	2	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Public policy has taken on a 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 efforts to identify current and emerging key public policies that address trade, environmental, agricultural and food issues of particular concern to policy makers, taxpayers, consumers, business persons and producers; analyze alternative public policies as to their design, use of economic incentives, cost effectiveness, transaction and administrative costs, incidence and consequences; and analyze alternative private responses and market based responses (e.g., trading of pollution credits) to existing public policies.

Results

Research in this area contributed to the development and extension of knowledge concerning the role of legal and economic analysis on environmental management in such areas as recycling, land use, and ecosystem services. The research has also added to the understanding of what it is about environmental and natural resources that the public values in such areas as Great Lakes coastal resources, watershed management, and water allocation schemes.

Work continues on a new volume on domestic and international standards for agricultural trade. A first draft is now complete, and the process of seeking a publisher and revising the manuscript has begun.

Analysis of the economic and ecological tradeoffs associated with the problems of wildlife disease has contributed to the development of better disease management strategies, especially related to bovine tuberculosis in Michigan and white-tailed deer and cattle, where cattle are at risk of disease from contacts with wild deer.

A Web site (www.pileus.msu.edu) was developed to provide climate projections over the next several decades for the tart cherry production area in the Great Lake states and posit implications for tart cherry yields and investments in the tart cherry sector.

A 2-day national workshop was held in Chicago, Nov. 13-14, 2008, on 'Linking Biophysical and Economic Models of Biofuel Production and Environmental Impacts.' Research presentations highlighted the high opportunity cost of replacing corn with dedicated cellulosic crops such as switchgrass.

4. Associated Knowledge Areas

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

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 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	7	9

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 U.S. agriculture and the costs of alternative strategies is critical to the long-term sustainability of the agrifood industry.

What has been done

Research to identify the more important and critical tactical and operational decisions facing Michigan agricultural producers and conduct economic analysis; analyze farm business and financial risk profile and performance in a rapidly changing environment; evaluate and develop new analysis techniques that are appropriate for tactical and operational decisions, and develop improved conceptual and analytical frameworks for understanding, assessing, implementing, and empirically studying effective agriculture, food and natural resource firm and industry innovation.

Results

A Web-based local government fiscal data input and access port was developed in conjunction with the Michigan Department of Treasury (<http://web4.canr.msu.edu/f65dev/>) and is scheduled to go live in the first quarter of 2009.

A comprehensive review of previous studies of supply potentials of various biofuel feedstocks, namely agricultural residues, ligno-cellulosic portions of municipal solid waste, forest and mill residues and dedicated energy crops such as switchgrass has been carried out and the summary article has been submitted to 'BioResources' Journal.

A state-level conference on 'Balancing Animal Agriculture and Michigan Communities' was organized and held. The conference included over 100 persons from the food and agriculture industry, state and local government, and academia.

An analysis of changing farmland values and rental rates and the structure of costs and returns of cash crop, fruit and swine farms in Michigan has been completed and disseminated via presentations and an Extension publication.

4. Associated Knowledge Areas

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

Outcome #7**1. Outcome Measures**

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

Not reporting on this Outcome for this Annual Report

Outcome #8**1. Outcome Measures**

Number of research programs to identify and evaluate human resources management practices in Michigan agricultural and green industries.

Not reporting on this Outcome for this Annual Report

Outcome #9**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 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	3	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 impact is critical to a competitive, sustainable Michigan economy.

What has been done

Research to analyze factors that influence the global agribusiness environment; examine research from India related to buyer-supplier relationships to inform the development of a theoretical model of behavioral relationships between retailers and suppliers based on a firm's degree of market orientation; and better understand the entire supply chains of various horticultural products, thus covering every segment of the chain, from retail, food service, second stage processing, wholesale and other logistics and service providers.

Results

A study on valuation of ecosystem services related to agriculture showed that the 18 percent increase in corn acreage in Michigan, Iowa, Minnesota and Wisconsin in 2007 was associated with a reduction in natural biocontrol of the soybean aphid worth an estimated \$58 million annually.

Results of a mail survey to 1800 Michigan corn and soybean farmers to assess their attitudes toward changing crop production practices to enhance ecosystem services output and their willingness to accept payment to adopt them showed that soil and water conservation practices are widely adopted, but farmers express doubts about the effectiveness of farming practices on global warming.

The Food SCENE Dialogues: Supply Chain Enhancements for the New Economy was a research project created to encourage dialogue and research on organizational, social and technological innovations that impact the food supply chain. The research project also created a Web site (www.aec.msu.edu/thefoodscene) to encourage dialogue and share research findings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
611	Foreign Policy and Programs
606	International Trade and Development
610	Domestic Policy Analysis

Outcome #10**1. Outcome Measures**

Number of research programs to evaluate how Michigan citizens use the Internet when searching for information about a vacation destination or planning a vacation.

Not reporting on this Outcome for this Annual Report

Outcome #11**1. Outcome Measures**

Number of research programs to determine rationale for farmland preservation choices and how changes will affect the Michigan tax base.

Not reporting on this Outcome for this Annual Report

Outcome #12

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 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	1	2

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The natural beauty and outstanding recreation 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 resource and wildlife managers to understand the recreational demands and economic benefits stemming from these important resources in order to protect, sustain and market them.

What has been done

Research to develop and extend economic models for estimating the demand for, and value of, recreational fisheries and wildlife resources; develop economic models and methods for estimating the public's preferences and values, including non-user values for fisheries and wildlife resources; and applying economic models to resource management issues.

Results

Research data was used to develop: a survey of farmer's willingness to accept payment to supply enhanced ecosystem services from agricultural lands through the adoption of low-input practices; models to determine the valuation of timber resources within a ecological-economic model of ecosystem service provision from Michigan forests; and travel cost valuation models for valuing beaches, beach access and the damages from beach closures on the Great Lakes.

A seminar, 'Institutional Context for Water Use Decisions and Policy Innovations in Michigan,' was held in October 2008 for researchers at Michigan Technological University summarizing the institutional context for water policy changes in Michigan and the potential for innovative water management tools in Michigan. Also, a seminar entitled 'Economic Valuation Tools and Techniques' was held at the Areas of Concern Statewide Public Advisory Council in June 2008.

4. Associated Knowledge Areas

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

Outcome #13**1. Outcome Measures**

Number of research programs to identify and evaluate the policy, technology and marketing issues faced by Michigan organic growers and develop responses.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	2	1

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The number of certified organic farms and the acres of farmland in certified organic production in the U.S. more than doubled from 1992 to 2005. In 2005, over 8,000 U.S. farmers had more than 4 million acres in certified organic production. Michigan has 205 certified organic farmers and 45,500 certified organic acres. For these reasons, it is important for organic growers to understand production, processing and marketing issues and to raise awareness among Michigan lawmakers about the value, importance and needs of organic agriculture.

What has been done

Research to assess the success of different types of farm and ranch diversification and the various reasons (e.g., characteristics of farmers/ranchers, geographic location) that contribute to successful diversification; apply and test alternative ways of classifying diversified farmers and ranchers (e.g., types of diversification enterprises, diversification goals and success achieving goals; and assess the relationship of agritourism to other forms of diversification and its potential to achieve various farm and ranch goals.

Results

Research to classify farmer markets and assess factors contributing to their success resulted in a demonstration (NYC Green Markets) of new methods and technologies for identifying and profiling farm markets, the geo-coding of 535 markets for which performance/success indicators are known, and written descriptions for these farmers markets.

A method and format for producing market analysis for farmers markets around the country has been developed and approved by USDA's Marketing Services Branch.

Peer-reviewed journal articles have been published that share information on how to define farm-ranch diversification and documents why diversification is an effective strategy to adjust to changes in the farm/ranch economy. Another describes the nature and extent of farm and ranch diversification including presenting a model of diversification.

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

Outcome #14**1. Outcome Measures**

Number of research programs to evaluate the competitiveness and marketing strategies and human resource management practices in Michigan agricultural and green industries.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	{No Data Entered}	4

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

U.S. produce industries are increasingly integrated with the global economy. U.S. buyers are able to meet their needs for a greater number of products from both domestic and imported goods. Similarly, U.S. producers seek access to a greater number of world customers. For these reasons, it is critical to understand the economic impacts of agricultural production and trade. Further, effective human resource management is the key driver in the overall success and sustainability of any industry.

What has been done

Research to describe market structure and production trends in food industries, their regulation and implications for Michigan produce markets; analyze the use of trade policies in the global movement of food and food products; evaluate industry competitive strategies in response to real and/or perceived change in agrifood systems and marketing; and analyze human resource management practices in agriculture, including recruitment, selection, training, evaluation, motivation, compensation/benefit systems, discipline and termination, and safety and health in Michigan and beyond.

Results

An empirical model of Good Agricultural Practice [GAPs] adoption in fresh strawberry markets was modified to include seasonality and shrinkage impacts. Results provide an indication of gains to firms as well as costs from adoption of additional food safety practices.

Results from an issue identification process convened by MAES/MSUE researchers at different locations throughout the state to better assess industry research and education needs were used to inform research efforts and program development in 2008. Results were also used to develop of a mail questionnaire. Surveys were mailed to 2,237 dairy farmers, 71 herdspersons and management employees, 171 next-generation family members in Michigan, and 480 allied industry professionals. Initial analysis of the survey responses focused on the opinions of dairy farm operators who participated in the survey.

4. Associated Knowledge Areas

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

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

We continue to review and refine planned program and outcome measure reporting in this report., hence the significant number of outcomes marked, "Not reporting on this outcome measure." In moving from five planned programs to six, some projects were moved into different planned programs than they were previously reported. In other instances, outcome measures were folded in to broader outcome measure categories to make reporting easier and more consistent. Further, the targets in this report (as they were in the previous year's report) compared to actuals aren't necessarily due to unmet goals, but rather a reconfiguration of goal associations and knowledge areas.

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- After Only (post program)
- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Case Study
- Comparisons between program participants (individuals,group,organizations) and non-participants
- Comparison between locales where the program operates and sites without program intervention

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

Program #6

V(A). Planned Program (Summary)

1. Name of the Planned Program

Animal Production and Protection

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals	3%		10%	
302	Nutrient Utilization in Animals	5%		10%	
303	Genetic Improvement of Animals	2%		8%	
304	Animal Genome	4%		5%	
305	Animal Physiological Processes	5%		5%	
307	Animal Management Systems	41%		25%	
308	Improved Animal Products (Before Harvest)	1%		2%	
311	Animal Diseases	28%		25%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	4%		2%	
315	Animal Welfare/Well-Being and Protection	3%		8%	
605	Natural Resource and Environmental Economics	1%		0%	
806	Youth Development	3%		0%	
Total		100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2008	Extension		Research	
	1862	1890	1862	1890
Plan	27.0	0.0	19.0	0.0
Actual	15.2	0.0	16.0	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
701726	0	1771496	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
701726	0	1489396	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	8530726	0

V(D). Planned Program (Activity)**1. Brief description of the Activity**

Research and Extension to:

Develop a better understanding of the processes that control/influence reproduction at the molecular and genetic level. Develop and test new cropping, grazing and feeding strategies for cattle, sheep and other ruminants for maximum profitability and animal health and minimal environmental impact. Develop and evaluate new nutritional management strategies for non-ruminant animals for maximum animal health and minimal environmental impact.

Develop and evaluate management/training strategies for race horses to reduce injuries.

Develop an understanding of the molecular processes that influence growth and meat quality in food animals.

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, including bovine viral diarrhea virus, leptospirosis, bovine tuberculosis, *Campylocacter jejuni*, West Nile virus, and bovine spongiform encephalitis.

Understanding of the environmental fate and biological effects of vaccines, steroids and other drugs fed to animals.

2. Brief description of the target audience

Michigan animal producers, agriculture and natural resources industry representatives, biotechnology company representatives, and state agency representatives.

V(E). Planned Program (Outputs)**1. Standard output measures****Target for the number of persons (contacts) reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
Plan	1853	3706	4265	0
2008	3188	6376	11613	0

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

Year Target

Plan: 7

2008 : 2

Patents listed

Provisional Patent Application filed 11/30/07, JY-1 Regulation of Granulosa Cell Function and Early Embryonic Development in Cattle (TEC2003-0053-01Prov)

Provisional Patent Application filed, 7/19/08, Methods and Compositions to Enhance Efficiency of Nuclear Transfer/Cloning (TEC2007-01 Prov)

3. Publications (Standard General Output Measure)**Number of Peer Reviewed Publications**

	Extension	Research	Total
Plan	5	18	
2008	1	48	49

V(F). State Defined Outputs**Output Target**

Output #1**Output Measure**

- Number of research programs on animal production and protection.

Year	Target	Actual
2008	19	38

Output #2**Output Measure**

- Number of adult participants trained in animal management systems.

Year	Target	Actual
2008	1483	1594

Output #3**Output Measure**

- Number of youth participants trained in animal management systems.

Year	Target	Actual
2008	4265	11613

Output #4**Output Measure**

- Number of adult participants trained in animal diseases.

Year	Target	Actual
2008	370	1594

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 develop and test new cropping, grazing and feeding strategies for cattle, sheep and other ruminants.
6	Number of research programs to develop and evaluate new nutritional management strategies for non-ruminant animals.
7	Number of research programs to develop and evaluate management tools and strategies for animal manure management.
8	Number of research programs to develop and evaluate management/training strategies for horses to reduce injuries.
9	Number of research programs to understand the molecular processes that influence growth and meat quality in food animals.
10	Number of research programs to add to the understanding of various food animal genomes by improving and integrating genetic maps.
11	Number of research programs to understand the genetic and molecular processes that control/influence the immune system in food animals.
12	Number of research programs to develop and evaluate new tools and strategies to detect, prevent and control emerging and reemerging livestock and poultry diseases.
13	Number of research programs to understand the environmental fate and biological effects of vaccines, steroids and other substances fed to 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	Quantitative Target	Actual
2008	1260	1355

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Michigan cattle producers requested help from MSUE in addressing the need for better screening of bulls to improve quality and reduce costs of poor breeding.

What has been done

The MSU Beef Team and the College of Veterinary Medicine conducted bull breeding soundness examinations (BSE) in early 2008 on 272 bulls owned by 86 Michigan cattle producers.

Results

Of the 272 bulls, 74 percent were judged to be satisfactory potential breeders, while 19 percent faced deferred judgment and 7 percent failed the exam because of major problems. Using these failed bulls in their breeding operations could have potentially cost producers \$120,500.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
307	Animal Management Systems

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	Quantitative Target	Actual
2008	3625	10336

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Animal projects are a significant part of local youth 4-H projects. Leaders need assistance to support their project areas and to provide educational assistance to youth in these projects, including technical assistance with animals, safety, and then information and training to sell.

What has been done

In every county 4-H youth were educated in proper care and management of their animal. Youth entered fair, showed their animal and participated in the auction with training. The auction was supported by a staff person trained in data entry and auction proceedings. Livestock Sale committees used to ensure appropriate business and financial accountability practices as well as work to minimize and handle disputes.

Results

These programs helped youth learn skills in animal management as well as helped them learn business practices. Typically, the 4-H Market Livestock Sales generate between \$10,000 to \$30,000 for participating youth, where the money goes back into the local and state economy. Every county in the state has similar (and often larger) outcomes.

4. Associated Knowledge Areas

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

Outcome #3**1. Outcome Measures**

Number of adult participants with increased knowledge of animal diseases.

2. Associated Institution Types

•1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	315	1355

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

One example, federal and international officials have expressed deep concern about the wide spread sickness and death of humans should a mutation of the Asian strain high path avian influenza become transmissible from human to human. There would be a resulting severe economic impact from such a pandemic as well. The disease has not been found in the USA to date and the federal government is dedicated to finding outbreaks early and eradicating them. Small flock owners need to know what bird flu would look like and who to call. In addition, questions and concerns about protecting small poultry flocks from Asian strain high path avian influenza or 'bird flu' were raised by commercial poultry farmers on the MI Allied Poultry Industries board, 4-H leaders and health department officials on county & state levels.

What has been done

Eight regional seminars were held in the evening or on Saturday to accommodate clients that likely work or attend school during week days. Seminars were held in Cass, Monroe, Lapeer, Ingham, Wexford, Chippewa and Delta counties. Overall there were 323 people attending the 8 seminars, an average of 40 per meeting. In addition, there were also presentations or literature at several 4-H leader meetings; April 8th at the Kettunen Center, March 25th SW 4-H Leader Meet at KBS and the MDA had their table top display & handouts at the Statewide 4H Poultry Show and Clinic May 13th in Hastings. MDA also had a vet and the display at all 8 of the seminars.

Results

Evaluation of the workshop found: 85% felt they had a better understanding of good small flock poultry production practices; 86% felt they understood how to reduce the chances of their poultry getting bird flu; 70% reported they were likely to change the way they managed their poultry flock to reduce their chance of getting bird flu; 86% reported an improved understanding of good food handling procedures to avoid food borne illness; and 80% felt they understood the symptoms of bird flu and know who to call if they saw them?

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
307	Animal Management Systems

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	Quantitative Target	Actual
2008	0	6

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% of the average American diet is dairy, and beef makes up about 10%. This makes these products an integral part of our lifestyle and our economy, thus sustained productivity and animal health are critical issues to the cattle industry.

What has been done

Research to develop new methods to improve fertility and reproductive efficiency in livestock;and investigate potential health effects of exposure to environmental contaminants in humans and animals, with an emphasis on reproductive performance.

Results

Further research on Ovsynch -- a program developed to synchronize ovulation for timed breeding in lactating dairy cows -- verified that beginning the Ovsynch program on day 6 or 7 of the estrus cycle maximizes the fertility of lactating dairy cows in timed artificial insemination programs. Workshops were held in 3 locations to educate 120 veterinarians from 18 states regarding this data and new strategies in dairy cow reproduction.

A chain graph framework approach for toxicity extrapolation related to different types of materials present on farms was developed and presented at the 2008 Philosophy of Science Association annual meeting.

Data on modified insemination techniques to improve sow fertility related to artificial insemination are now included in an online course in Swine Herd Reproductive Management and is currently being translated into Spanish.

The most recent findings on reproductive efficiency as a major determinant of economic success in beef and dairy operations were disseminated at the 2008 Annual Meeting of the Society for the Study of Reproduction in Kona, Hawaii.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
304	Animal Genome
305	Animal Physiological Processes
301	Reproductive Performance of Animals

Outcome #5

1. Outcome Measures

Number of research programs to develop and test new cropping, grazing and feeding strategies for cattle, sheep and other ruminants.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	4

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 was conducted to develop forage systems that will maximize the economic and energetic efficiency of dairy cattle; increase efficiency of protein production in dairy cows; collect forages, grains and agricultural crop by-products and residue and other alternative feeds and determine their composition and nutritional value by standard analytical procedures; and to develop methods to enhance decision-making by dairy producers.

Results

Research efforts in nutrition modeling and building practical nutrition software tools for farmers resulted in the development of the Spartan Dairy 3 Program -- a stand alone database program that has been used in the classroom and will be released to producers in the near future.

Forage system research has produced important tools for dairy operators such as Corn Picker for Silage (www.msu.edu/~mdr/cornpicker1.05.xls); and Michigan Corn Hybrids Compared (www.css.msu.edu/varietytrials/corn/Corntrials.htm) to more precisely determine ration balancing and its effect on the input-output process to optimize profit.

Research in dairy herd performance and overall herd and cow health status has resulted in an expanded biosecurity check list and the development of a check list for a farm entrance/gate protocol package that is part of a biosecurity STOP SIGN Campaign that encourages dairy and beef producers to create one farm entry point, place a STOP sign in the entry point to have visitors check with management before entering animal facilities and screen visitors who have recently visited other farms and countries.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
302	Nutrient Utilization in Animals

Outcome #6**1. Outcome Measures**

Number of research programs to develop and evaluate new nutritional management strategies for non-ruminant animals.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	1	3

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

As production costs rise, farms consolidate, 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 protects human and animal health.

What has been done

Research was conducted to evaluate the use of oligosaccharides in the diets of laying hens and their effect on egg production/quality and disease; determine the influence of fiber, potassium, copper and zinc sources and protein concentrations on fecal excretion in lactating sows; determine the influence of quantity of feed consumed during lactation and various fiber sources on daily fecal volume of swine; determine the influence of zinc on the structural soundness and productivity of sows. and optimize protein and amino acid nutrition of swine and equine related to performance and efficiency of protein utilization.

Results

Research indicated that the dressing percentage of sows was not altered when distillers dried grains and solubles were added up to 30 percent of the diet. This work was reported at the 2008 Midwest American Society of Animal Science meeting.

Additional research was undertaken to study the welfare issue of cone and cartilage health of swine. It was found that even a short amount of exercise in mature gilts housed in gestation crates improves bone formation due to a denser and wider bone. These results are extremely important as the seine industry continually strives to improve the welfare of its animals.

4. Associated Knowledge Areas

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

Outcome #7**1. Outcome Measures**

Number of research programs to develop and evaluate management tools and strategies for animal manure management.

Not reporting on this Outcome for this Annual Report

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	Quantitative Target	Actual
2008	1	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 20's and even 30's. While 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

Two projects were conducted evaluating the glycemic and insulinemic responses of horses to various feeds with the theory being that high insulinemic responses are related to health problems such as osteochondrosis and laminitis. An additional study evaluated the preference of horses to feeds with varying amounts of fish oils with the idea that the fish oil will increase the omega-3 fatty acid concentration of the diet which may decrease joint inflammation and improve soundness.

Results

Studies were completed evaluating the recommended dietary allowance for phosphorus and whether phytase can influence digestibility. Phosphorus is necessary for proper bone development and is rarely lacking in the equine diet. However, given the concern with environmental contamination of excess phosphorus, the amount in the equine diet will need to be decreased, necessitating further research into the precise demands of horses.

An additional study evaluated the preference of horses to feeds with varying amounts and types of fish oils which could increase the omega-3 fatty acid concentration of the diet and potentially decrease joint inflammation and improve soundness. Results showed that horses tend to have a taste aversion to the addition of such oils to the diet making the inclusion impractical unless the taste/smell can be masked.

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 understand the molecular processes that influence growth and meat quality in food animals.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	3

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The molecular basis underpinning beef and pork quality is highly complex, and continued advances in understanding the biological processes that contribute to the delivery of consistent quality meat is critical to the sustainability and security of the industry. Knowledge gained from research efforts in this area can be beneficial in defining an optimizing management systems for quality, providing assurance of meat quality and in tailoring quality to suit market needs.

What has been done

Research efforts to discover and evaluate genetic factors that influence growth, carcass merit and meat quality of swine; identify characteristics of skeletal muscles associated with superior and inferior meat quality, and develop strategies for consistent production of high quality meat products.

Results

New knowledge regarding molecular markers have been verified for use in marker assisted selection programs. Experiments estimated transcriptional profile quantitative trait loci(QTL) and showed that increasing marker density increased the significance of previously discovered QTL and also decreased the chromosomal interval in which the QTLs were located. A new QTL for firmness was also discovered that had not been previously reported. Gene expression profile data were also generated from experiments using pigs with and extreme longissimus muscle area from the MSU Resource population. This data will be used to validate QTL in an industry pig population.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
308	Improved Animal Products (Before Harvest)
305	Animal Physiological Processes

Outcome #10

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 Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	0	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Genetic maps are an integral part of several statistical methods 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 enhance and integrate genetic and physical maps of agriculturally important animals for cross-species comparisons and sequence annotations; facilitate integration of approaches toward better understanding of biological mechanisms underlying economically important traits; and implement tools to extract, analyze, store and disseminate information.

Results

A biosecurity check list was expanded and added to an overall farm entrance/gate protocol package that is part of a biosecurity STOP SIGN Campaign. The campaign is being developed to get dairy and beef producers to create one farm entry point, place a STOP sign in the entry point to have visitors check with management before entering animal facilities, screen visitors who have recently visited other farms and countries and have them sign a log and wash boots or use plastic boots.

Research to improve the efficiency of somatic cell nuclear transfer (SCNT) in cattle has been completed and the largest commercial producer of cloned animals in the U.S. will be testing one of the protocols developed. Datasets were made available to the public and primary cell lines that underwent de-differentiation have been shared with national and international collaborators.

4. Associated Knowledge Areas

KA Code	Knowledge Area
304	Animal Genome
305	Animal Physiological Processes

Outcome #11

1. Outcome Measures

Number of research programs to understand the genetic and molecular processes that control/influence the immune system in food animals.

Not reporting on this Outcome for this Annual Report

Outcome #12

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 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2008	1	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 U.S. following an outbreak in the mid-1980s 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 collect and screen for bacterial strains with antagonistic properties for food-borne pathogens and test their efficacy; develop a rapid, low-cost animal side biosensor for detecting cattle persistently infected with bovine diarrhea virus; and detect new or emerging infectious diseases in livestock and poultry; and how to improve immune recognition in order to protect against or eliminate viruses and cancers.

Results

Continued research on rapid and cost effective diagnostic assays for the detection of cattle persistently infected with bovine viral diarrhoea virus resulted in the development of a biosensor capable of reliably detecting 10-4 CCID/ml of virus in less than 2 minutes.

Work on Equine Multinodular Pulmonary Fibrosis (EMPF), a newly identified fatal disease of middle age to old horses, continued during 2008. Work documenting the association between the equine gammaherpesvirus EHV-5 and EMPF has been published and disseminated. The development of diagnostic tests for EHV-5 has led to an increase in diagnostic submissions for detection. This work has also led to collaborations with a variety of veterinary clinicians and pathologists throughout the United States and Canada.

Research on the neutrophil gene expression signature suggests that glucocorticoid genetically reprograms circulating neutrophils, increasing the potential for facilitating tissue remodeling, wound healing and fighting bacteria.

Analysis of immune evasion molecules in feline herpesvirus-1 (FHV-1) and in Marek's Disease Virus (MDV) of chickens resulted in the identification of the MHC class I immune evasion molecule in FHV-1. Researchers are using the findings to construct mutant viruses that lack the immune evasion molecule. Researchers have also tentatively identified the immune evasion molecule of MDV and are cloning and analyzing this gene as well.

4. Associated Knowledge Areas

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

Outcome #13

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	Quantitative Target	Actual
2008	0	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Michiganans are an exceptionally vulnerable population due to their chronic exposure to complex mixtures of endocrine disruptors that 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 waste generated by these operations must be assessed.

What has been done

Research efforts to develop analytical methods to measure inorganic and organic substances in a variety of environmental situations; identify the environmental transformations undergone by animal feed additives and determine their environmental fate; and assess the potential of these substances to alter the immune response and cause severe disease symptoms in animals and humans.

Results

Researchers at MSU cooperated with researchers at the University of Maryland and Purdue University to demonstrate effective diet modification strategies to reduce air emissions while maintaining animal performance and reasonable diet costs. A matrix that documents the impact of diet and post-excretion amendment both collectively and individually will be developed from the findings. 113 tours of the research facility were conducted during 2008, many of which were for producers and stakeholders. Raw data from the project was shared and implications were discussed with participants.

Recently completed trials determined that a series of multiple immunizations with J5 E.coli bacterium is more effective in stimulating antibody response when injection sites are sequentially rotated about the body, as opposed to injection in the same body location. Continuing education seminars regarding the immunology of J5 E.coli bacterium and prudent antibiotic use in the therapy of mastitis were held at the Michigan Veterinary Conference, the National Mastitis Council's regional meeting and meetings of the Czech Republic Buiatric Society and Canadian Veterinary Association.

4. Associated Knowledge Areas

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

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

We continue to review and refine planned program and outcome measure reporting in this report., hence the significant number of outcomes marked, "Not reporting on this outcome measure." In moving from five planned programs to six, some projects were moved into different planned programs than they were previously reported. In other instances, outcome measures have been folded in to broader outcome measure categories to make reporting easier and more consistent. Further, the targets in this report (as they were in the previous year's report) compared to actuals aren't necessarily due to unmet goals, but rather a reconfiguration of goal associations and knowledge areas.

V(I). Planned Program (Evaluation Studies and Data Collection)**1. Evaluation Studies Planned**

- After Only (post program)
- Before-After (before and after program)
- Case Study
- Comparisons between program participants (individuals, group, organizations) and non-participants
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.
- Comparison between locales where the program operates and sites without program intervention

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}