

# **Michigan Agricultural Experiment Station Plan of Work 1999-20004**

## **Introduction**

Michigan State University, established in 1855, is the country's premier land-grant institution. It is home to the Michigan Agricultural Experiment Station, established in 1888 after the passage of the Hatch Act in 1887.

The mission of the Michigan Agricultural Experiment Station (MAES) is to generate knowledge through strategic research to enhance agriculture, natural resources, families and communities in Michigan. The MAES encompasses the work of more than 300 scientists in five colleges at Michigan State. The MAES system also includes 16 field research stations located at various sites around the state. Each field research station focuses on the particular needs of the area in which it is located — horticultural crops on the west side of the state, forestry management and products in the Upper Peninsula, and sugar beets and dry beans in the Thumb are just three examples.

To fulfill its mission, the MAES needs to have a balance between disciplinary/basic research programs and applied research programs. To keep up with the changing needs of Michigan residents, the MAES has a continuing prioritization process. MAES priorities and projects are periodically examined and updated as the needs of Michigan change. Specific examples of MAES programs and projects that relate to federal goals are listed under each goal.

This five-year plan of work outlines the goals of the Michigan Agricultural Experiment Station at Michigan State University. Though many goals are long-term, we anticipate that these programs will have an immediate impact on relevant stakeholders.

## **Stakeholder Input**

The MAES has established and implemented a process to obtain input on the use of formula funds from people who use agricultural research. At least once a year, MAES administrators meet with representatives of each commodity or interest group in Michigan to review the work that has been done over the past year and to discuss the continued and emerging research needs of each group. Key MAES researchers, encouraged by MAES administrators, also meet with industry representatives to determine groups' individual needs. MAES administrators also meet throughout the year with representatives of Michigan Farm Bureau, the Michigan departments of Agriculture, Natural Resources and Environmental Quality, and other state/agency groups to discuss the agricultural and natural resources issues facing the state's citizens. Educational field days at the 16 MAES field research stations located around the state provide another opportunity for producers, consumers, industry representatives and other concerned citizens to discuss issues with MAES administrators and researchers.

Many academic departments affiliated with the MAES appoint private citizens who benefit from MAES research to serve on faculty position selection committees. This is done to address the needs and interests of people who are most likely to be affected by the research program of the person hired for the position.

The MAES has established a series of coalitions to address a range of issues important to Michigan: children, youth, families and communities; plant sciences; natural resources; etc. People who are considered leaders in each of the areas serve on the respective coalition and have a voice in directing the coalition's actions. This includes setting priorities for research and extension activities in that area, funding, and input into the direction of both the MAES and MSU Extension.

The MAES, in conjunction with MSU Extension, has also established a statewide advisory council to provide insight, information, direction and assistance in setting priorities. The council meets quarterly.

The MAES is also using the results of a survey done by the MSU Institute for Public Policy and Social Research to tailor information dissemination. A random sample of Michigan adults were asked how they preferred to receive research information, as well as which issues in children, youth, families and communities were most important to them.

The MAES is constantly trying to encourage stakeholders to provide more input and to develop a sense of ownership about MAES research. Every effort is made to receive input from and create programs to address the needs of underserved populations, including Hispanics and the urban poor.

### Merit and Peer Review

All MAES projects funded by federal formula funds are peer reviewed before being funded. Each project undergoes at least two peer reviews by two independent faculty member reviewers, as well as review by the department chairperson and MAES administrators.

Competitive grant programs use review panels for all awards. These review panels include commodity group representatives and other external stakeholders.

# Goal 1: An Agricultural Production System That Is Highly Competitive In The Global Economy

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## Statement of Issue:

Agriculture adds nearly \$40 billion to Michigan's economy when all aspects of production, processing and retail operations are considered. Food/agriculture is the state's second most important industry in economic terms, and the state's most stable, employing more than 500,000 people every year.

Agriculture in the state is impressively diverse — Michigan ranks third behind California and Florida in number of crops grown. Surrounded by the Great Lakes, the state has the ideal climate and soil conditions for floriculture, nursery and fruit crops in the western part of the state. The Thumb provides model conditions for dry beans and sugar beets, and southeastern Michigan boasts large numbers of turf and nursery operations. The Michigan Department of Agriculture reports that Michigan ranks in the top five producing states for 35 crops and is the No. 1 producer of several types of dry beans, blueberries, cucumbers for pickles, tart cherries, Easter lilies and summer potatoes. These specialty crops contribute to the state's agricultural strength, but they all require specific growing techniques and research.

Animal agriculture accounts for half of Michigan's agricultural income and provides more than 56,000 jobs. It includes dairy, hogs, cattle, sheep, eggs, horse racing, pleasure and sport riding, turkey operations, dairy and meat processing plants, and grain and forage crops.

Every county in Michigan benefits from agriculture, and scientists in the Michigan Agricultural Experiment Station, with input from the state's commodity groups, are working on a number of projects to ensure the continued competitiveness and robustness of Michigan agriculture in the next five years.

The MAES has three main thrusts that fall under this goal: value-added products, plant production agriculture and animal production systems. The MAES has long-term commitments to these programs but wants quick results from specific projects that will lead to other innovative work.

Because the Evaluation Framework and Output Indicators remain constant for each program area under Goal 1, they have been placed before the program areas. Because the Allocated Resources pertain to the entire goal, they have been placed before the program areas as well.

## Allocated Resources

	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
<b>Hatch Funds</b>						
Hatch Regular	2,694,810	2,640,914	2,588,095	2,536,334	2,485,607	2,435,895
Multi-State Funds	600,506	600,506	600,506	600,506	600,506	600,506
Other CSREES Funds*	4,393,258	4,393,258	4,393,258	4,393,258	4,393,258	4,393,258
Other Federal Funds*	6,351,427	6,351,427	6,351,427	6,351,427	6,351,427	6,351,427
<b>Total Federal Funds (est.)</b>	<b>14,040,000</b>	<b>13,986,104</b>	<b>13,933,286</b>	<b>13,881,524</b>	<b>13,830,797</b>	<b>13,781,085</b>
State Match for Hatch Funds	3,295,316	3,241,420	3,188,602	3,136,840	3,086,113	3,036,401
Remaining State Appropriations	17,125,299	17,791,814	18,475,629	19,177,318	19,897,469	20,636,689
Self Generated Funds*	1,944,346	1,944,346	1,944,346	1,944,346	1,944,346	1,944,346
Industry Generated Funds*	3,994,474	3,994,474	3,994,474	3,994,474	3,994,474	3,994,474
Other Non-Federal Funds*	756,217	756,217	756,217	756,217	756,217	756,217
<b>Total State Funds (est.)</b>	<b>27,115,652</b>	<b>27,728,270</b>	<b>28,359,267</b>	<b>29,009,194</b>	<b>29,678,619</b>	<b>30,368,126</b>
<b>Total Estimated Funds</b>	<b>41,155,652</b>	<b>41,714,374</b>	<b>42,292,553</b>	<b>42,890,718</b>	<b>43,509,416</b>	<b>44,149,212</b>
<b>Scientist Years</b>	90.4	90.4	91.4	91.4	91.4	91.4

\*Value extracted from the Fiscal Year 1998 Funds and Manpower Report.

## Evaluation Framework:

All MAES faculty members are required to have a five-year umbrella project. This is evaluated by two independent faculty member reviewers, as well as reviewed by the department chairperson and MAES administrators. Other evaluation tools used will include evidence of scholarly activities, including refereed journal articles; publication of Extension bulletins; the annual departmental performance reviews; and feedback from annual meetings with commodity and industry groups on the satisfactory progress of projects. For some research -- plant breeding for example -- it is more valuable to evaluate the work as it progresses rather than wait until the project is completed. The MAES will use the evaluation tools previously listed to evaluate on-going as well as completed projects.

## Output Indicators:

MAES research program output will be assessed by reviewing the number of publications created from the research, the amount of external funding received, and the number of proposals submitted by the researcher.

# **Value-added Products**

## **Key Program Components:**

\* Determining the genetic structure of oilseed crops to manipulate them to produce industrially valuable fatty acids.

\* Purifying, characterizing the chemical composition and synthesizing natural products from plants and microbes. These compounds are being tested for use as anticancer, antioxidant, anti-inflammatory, antifungal, antibacterial, nematocidal, insecticidal and herbicidal agents. Also being studied are anti-inflammatory and antioxidant compounds from tart cherries and their effect on the quality of meat products and heterocyclic aromatic amine formation (HAA) when added into meat.

\* Developing new uses for agricultural crops, including creating a process to make brandy from Michigan fruits (cherries, pears, peaches, apples and plums) and greater utilization of corn biomass.

\* Initiating new-wave cooperatives based on the needs of Michigan's commodity groups and producers.

## **Performance Goals:**

### **Short-term Goals**

\* To open a \$1.5 million, 5,000-square-foot oilseed processing plant to produce engine oil from canola and soybeans. Growers participating in the venture will receive 50 cents per bushel above commercial market prices for canola seeds and soybeans.

(Joint program with MSU Extension, the College of Agriculture and Natural Resources, and a growers cooperative.)

### **Intermediate-term Goals**

\* To create a Natural Products Center at Michigan State University. This will allow researchers working in both agricultural and biomedical research to work more efficiently and collaboratively.

(Multidisciplinary program; joint with the Office of the Vice President for Research and the College of Agriculture and Natural Resources.)

\* To open an alfalfa dehydration facility in western Tuscola County. The facility would operate 29 weeks per year and process a variety of alfalfa cube products. Besides providing income from the products made from it, alfalfa also improves soil health for sugar beet growers who incorporate it into their rotations.

(Joint program with MSU Extension, the Sugar Beet Advancement Committee, and the College of Agriculture and Natural Resources.)

\* To expand the fruit fermentation research program to develop the technology to produce alcoholic fruit beverages, including liqueurs and ports.

(Multidisciplinary program; joint with the Cherry Marketing Institute, the Office of the Vice President for Research, the College of Agriculture and Natural Resources, the Michigan Department of Agriculture, and Michigan Farm Bureau.)

\* To create a number of new sodium-free products, including soups and snacks, using the technology that created HälsoSalt. The technique ferments cornstarch to produce lysine, a salty amino acid. MAES scientists then found a way to turn powdered lysine into a crystal, so it looks and acts like salt -- it sprinkles, it dissolves and it cooks. The crystallized lysine, which masks the bitter taste of potassium, is mixed with potassium chloride (a natural salt that is the base for many salt substitutes) and succinic acid (a naturally occurring acid found in many fruits) to make HälsoSalt, which has no bitter aftertaste.

(Multidisciplinary program; joint with the Michigan Corn Marketing Committee, the Office of the Vice President for Research, and the College of Agriculture and Natural Resources.)

### **Long-term Goals**

\* Through the Crop and Food Bioprocessing Center, scientists are working to create chemicals for food products, cleaning products, industrial solvents and polymers from the fermentation of plant biomass, primarily from Michigan agricultural crops. Biobased industrial products will be a major U.S. economic growth area in the next century as fossil-based industrial products, such as synthetic chemicals and liquid fuels, in the 20th century. Biobased industrial products will improve economic security through use of domestic rather than imported resources, optimal use of currently unused or underused land, and geographically widespread production and manufacture across the United States.

(Multidisciplinary program; joint with the Michigan Corn Marketing Committee, the Office of the Vice President for Research, the Michigan Soybean Promotion Committee, and the College of Agriculture and Natural Resources.)

### **Internal and External Linkages:**

The MAES will work with:

\* MSU Extension to open the oilseed processing plant and the alfalfa dehydration facility.

\* A growers cooperative to open the oilseed processing plant.

\* The MSU Office of the Vice President for Research and Graduate Studies to create a Natural Products Center on campus, to expand the fruit fermentation program, to create new sodium-free products and to create new biobased chemicals from Michigan agricultural products.

- \* The Sugar Beet Advancement Committee to open the alfalfa dehydration facility.
- \* The Cherry Marketing Institute to expand the fruit fermentation program.
- \* The Michigan Corn Marketing Committee to create new sodium-free products and to create new biobased chemicals from Michigan agricultural products.
- \* The Michigan Soybean Promotion Committee to create new biobased chemicals from Michigan agricultural products.
- \* The College of Agriculture and Natural Resources to open the oilseed processing plant and the alfalfa dehydration facility, to create new sodium-free products, to expand the fruit fermentation program and to create new biobased chemicals from Michigan agricultural products.
- \* The Michigan Department of Agriculture and Michigan Farm Bureau to create a value-added center for Michigan farmers.

### Target Audiences:

MAES programs in value-added products are intended to assist agricultural producers and processors, consumers and retailers in Michigan. These programs will also identify and assist food entrepreneurs to develop businesses and enhance the state's economy.

### Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

- \* Is an oilseed processing plant operating?
- \* Is there a Natural Products Center on the MSU campus?
- \* Is an alfalfa dehydration facility operating?
- \* Are fruit liqueurs and fruit ports being produced?
- \* Are new sodium-free products being produced?
- \* Are food products, cleaning products, industrial solvents and polymers being produced from the fermentation of corn?

# **Plant Production Agriculture**

## **Key Program Components:**

\* Enhancing the economic viability of producers and processors of Michigan's more than 65 specialty/minor crops.

\* Helping Michigan growers comply with the new pesticide use and residue regulations mandated by the Food Quality Protection Act by developing new methods of pest and disease control, maintaining the Pesticides-At-Risk (PAR) database and registering pesticides for use on minor/specialty crops.

\* Understanding the structure and function of plant genomics, including molecular mapping; specially designed plants that produce desirable compounds such as biodegradable plastic, phytoremediation; natural ecosystems; principles of plant growth and development; and plant pest control.

\* Meeting the needs of Michigan's floriculture and turf industries.

## **Performance Goals:**

### **Short-term Goals**

\* To create new diagnostic lab services for Michigan residents. The facility, Diagnostic Services, will include diagnoses of weed, plant disease, insect and nematode problems. It also will assist in the identification of fungi and plants. It will combine the work of the former Plant and Pest Diagnostic Clinic, the Arthropod Diagnostic Clinic and the Nematode Diagnostic Service Laboratory.

(Joint program with MSU Extension, and the colleges of Agriculture and Natural Resources and Natural Science; multidisciplinary program.)

\* To strengthen applied research in the plant sciences, crop integrators in nursery, fruit, vegetables and field crops will be hired. They will be located on campus and will offer individual industries another direct link to MSU expertise.

(Joint program with MSU Extension, the College of Agriculture and Natural Resources and Michigan plant commodity groups; multidisciplinary program.)

\* To strengthen the plant sciences, a scientist who specializes in phytoremediation (using plants to reduce and contain environmental contaminants in the environment) will be hired.

(Multidisciplinary program; joint program with the Office of the Provost, and the College of Agriculture and Natural Resources.)



## **Intermediate-term Goals**

\* To strengthen plant research programs, three scientists in plant genomics will be hired: one in applied structural genetics, one in functional genetics and one in bioinformatics.

(Multidisciplinary program; joint program with the College of Agriculture and Natural Resources, and the Office of the Provost.)

\* Two scientists who specialize in genetically engineered plants will be hired to design new plant products, such as pharmaceuticals, nutraceuticals and other valuable materials.

(Multidisciplinary program.)

\* To develop new growing strategies for flowering plant growers. So far, MAES scientists have chosen 100 perennial plants and determined the conditions that cause each to flower — growers can follow a prescribed plan and can make the plants flower whenever they'd like, offering growers more opportunities to sell plants.

(Joint program with MSU Extension and the College of Agriculture and Natural Resources.)

## **Long-term Goals**

\* To maintain and update the Pesticides-At-Risk (PAR) database. This database examines critical pesticides used for each crop grown in Michigan and ranks them according to the impact of their loss on the state's agricultural economy.

(Joint program with MSU Extension and the colleges of Natural Science and Agriculture and Natural Resources; multidisciplinary program.)

\* To establish a centralized recruiting and application process for the plant sciences so MSU can continue to attract the very best plant science graduate students.

(Multidisciplinary program.)

\* To register pesticides for use on minor/specialty crops. MSU is home to one of four multistate laboratories through National Research Support Project 4 that helps specialty crop producers maintain access to effective pesticides.

(Multistate program.)

\* To develop new plant varieties that are resistant to diseases and insects and have the necessary agronomic traits to benefit Michigan producers.

(Multidisciplinary program; joint with Michigan plant commodity groups and the College of Agriculture and Natural Resources.)

\* To maintain the national reputation that MSU has in plant science research.

## Internal and External Linkages:

The MAES is working with:

- \* MSU Extension on creating new diagnostic lab services, hiring crop integrators, developing new growing strategies for flowering plant growers and maintaining the Pesticides-At-Risk database.

- \* The College of Natural Science to create new diagnostic lab services and maintain the Pesticides-At-Risk database.

- \* Michigan plant commodity groups to hire crop integrators and develop new plant varieties.

- \* The College of Agriculture and Natural Resources to create new diagnostic lab services, hiring crop integrators, develop new growing strategies for flowering plant growers, maintain the Pesticides-At-Risk database, and hire a phytoremediation specialist and three plant genomics scientists

## Target Audiences:

MAES programs in plant production agriculture are intended to assist agricultural producers and processors, consumers and retailers in Michigan.

## Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

- \* Do Michigan residents have access to new diagnostic laboratory services?
- \* Were integrated crop management coordinators hired for fruit, vegetable and ornamental crops?
- \* Were crop integrators hired for nursery, fruit and field crops?
- \* Was a phytoremediation scientist hired?
- \* Were three plant genomics scientists hired (one in applied structural genetics, one in functional genetics and one in bioinformatics)?
- \* Were two scientists who specialize in genetically engineering plants hired?
- \* Is the Pesticides-At-Risk database being updated and maintained?

- \* Has a centralized recruiting and application process for the plant sciences been established?
- \* Are pesticides being registered for use on minor/specialty crops?
- \* Are new growing strategies being developed for flowering plant growers?
- \* Are new plant varieties being developed?

## **Animal Production Systems**

### **Key Program Components:**

- \* Better understanding of animal diseases, animal nutrition and animal health.
- \* Manure management.
- \* Animal genomics, including work to identify genes that control economically important traits such as reproduction, well-being, growth, milk production, and disease resistance; development of transgenic mouse models of chronic human disease; development of transgenic livestock models for human disease; and biopharmaceutical production.

### **Performance Goals:**

#### **Intermediate-term Goals**

- \* To combat bovine tuberculosis infection in wild white-tailed deer in Michigan and return the state to TB-free status. This includes:
  1. Developing a highly sensitive, specific and rapid test for *Mycobacterium bovis*, the bacterium that causes bovine tuberculosis in deer.
  2. Developing a way to genetically characterize various strains of bovine tuberculosis.
  3. Determining patterns of antimicrobial resistance among *Mycobacterium bovis* strains.
  4. Determining the pathogenesis of *Mycobacterium bovis* in deer and other animals.
  5. Determining the epidemiology of bovine tuberculosis in Michigan.
  6. Evaluating the effectiveness of bovine tuberculosis surveillance and control program in Michigan.

7. Determining the economic and social impact of bovine tuberculosis on Michigan.

(Joint program with MSU Extension, the College of Agriculture and Natural Resources, the Michigan Department of Agriculture, the Michigan Department of Natural Resources and the USDA; multidisciplinary program.)

- \* To study the epidemiology of Johne's Disease.

(Joint with the colleges of Veterinary Medicine and Agriculture and Natural Resources.)

- \* To develop enterprise-level systems models in irrigation and waste management for dairy, swine and poultry operations that evaluate ration tradeoff, land availability and total production.

(Joint project with MSU Extension, the College of Agriculture and Natural Resources, the Michigan Department of Agriculture, the Michigan Department of Environmental Quality and animal commodity groups; multidisciplinary program; multistate program.)

- \* To develop and refine methodology, technology and management practices to reduce odors, gases, and airborne microflora, particulate matter and other airborne emissions in animal production systems.

(Multidisciplinary program; multistate program; joint with MSU Extension and the College of Agriculture and Natural Resources.)

- \* To develop and evaluate feeding systems for their potential to alter the excretion of environmentally sensitive nutrients by livestock.

(Multidisciplinary, multistate program.)

- \* To create a strategic partnership to initiate a new research area in the identification of candidate genes that control traits of importance for humans and animals (e.g., genes for leanness and disease resistance). In addition, this partnership will provide information for gene mapping and a better understanding of gene regulation.

(Multidisciplinary program; joint with the Office of the Provost, the College of Agriculture and Natural Resources, and the Office of the Vice President for Research and Graduate Studies.)

- \* To establish a Hannah Professorship in animal biotechnology/transgenics.

(Joint program with the Office of the Provost and the College of Agriculture and Natural Resources.)

### **Long-term Goals**

- \* To establish a transgenic animal facility at Michigan State University to facilitate research in developing transgenic mouse models of chronic human disease, basic research in cloning, and developing transgenic livestock models for human

disease and biopharmaceutical production and study of gene function.

(Multidisciplinary program; joint program with the Office of the Provost, the Office of the Vice President for Research and Graduate Studies, and the colleges of Agriculture and Natural Resources and Veterinary Medicine.)

\* To provide objective criteria for the evaluation of animal welfare indicators in various species. The biology of systems for coping with the environment may be different among animal species, and scientific investigation needs to be carried out to identify useful and reliable indicators. The causes of welfare problems may be associated with long-term or short-term problems. Housing systems, management methods, operations and other procedures, accidents, neglect or deliberate cruelty which might cause poor welfare need to be investigated.

(Multidisciplinary; joint project with the Scottish Agricultural College, the College of Agriculture and Natural Resources, and the Office of the Vice President for Research and Graduate Studies.)

### Internal and External Linkages:

The MAES will work with:

\* MSU Extension to combat bovine tuberculosis in deer in Michigan; to develop methodology to reduce airborne emissions in animal production systems; and to develop models in irrigation and waste management for dairy, swine and poultry operations.

\* The Michigan Department of Natural Resources to combat bovine tuberculosis in deer.

\* The Michigan Department of Agriculture to combat bovine tuberculosis in deer.

\* The Michigan Department of Environmental Quality to develop models in irrigation and waste management for dairy, swine and poultry operations.

\* The Office of the Vice President for Research and Graduate Studies to identify candidate genes; establish a transgenic animal facility and provide objective criteria for evaluating animal welfare.

\* The Office of the Provost to identify candidate genes, to establish a Hannah Professorship and to establish a transgenic animal facility.

\* The Scottish Agricultural College to provide objective criteria for evaluating animal welfare.

\* The College of Agriculture and Natural Resources to combat bovine tuberculosis in deer in Michigan; to develop methodology to reduce airborne emissions in animal production systems; to develop models in irrigation and waste management for dairy, swine and poultry operations; to identify candidate genes; to establish a transgenic animal facility; to provide objective criteria for evaluating animal welfare; to study the epidemiology of Johne's Disease; and to establish a Hannah Professorship.

\* The College of Veterinary Medicine to study the epidemiology of Johne's Disease and to establish a transgenic animal facility.

### Target Audiences:

MAES programs in animal production systems are intended to assist agricultural producers and processors, consumers and retailers in Michigan.

### Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

- \* Was a rapid test for *Mycobacterium bovis* developed?
- \* Can different strains of bovine tuberculosis be genetically characterized?
- \* Have patterns of antimicrobial resistance among *Mycobacterium bovis* strains been determined?
- \* Has the pathogenesis of *Mycobacterium bovis* in deer and other animals been determined?
- \* Has the epidemiology of bovine tuberculosis in Michigan been determined?
- \* Has the effectiveness of bovine tuberculosis surveillance and control programs in Michigan been evaluated?
- \* Have the social and economic impacts of bovine tuberculosis on Michigan been determined?
- \* Has the epidemiology of Johne's Disease been determined?
- \* Have enterprise-level systems models in irrigation and waste management for swine, dairy and poultry operations been developed?
- \* Have the methodology, technology and management practices been developed to reduce odors, gases, and airborne microflora, particulate matter and other airborne emissions in animal production systems?
- \* Have new feeding systems designed to alter the excretion of environmentally sensitive nutrients by livestock been developed and evaluated?
- \* Has a strategic partnership to initiate a new research area in the identification of candidate genes that control traits of importance for humans and animals been established?

\* Has a Hannah Professorship in animal biotechnology/transgenics been established?

\* Has a transgenic animal facility been established at Michigan State University?

\* Have objective criteria for evaluating animal welfare been developed?

# Goal 2: A Safe and Secure Food and Fiber System

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## Statement of Issue:

Food safety once again made headlines in Michigan at the end of 1998. News stories reported that the U.S. Centers for Disease Control and Prevention were blaming *Listeria*-contaminated hot dogs and lunchmeat from a processing plant in Zeeland for the deaths of 12 people and sickness of 79 others. Then the U.S. Department of Agriculture ordered Southfield-based Thorn Apple Valley, Inc., to recall 30 million pounds of hot dogs and lunchmeat. No illnesses or deaths were attributed to the products, but the plant was cited for unsanitary conditions. Then Detroit-based Hygrades, owned by Sara Lee, took 72,000 packages of hot dogs made at its Detroit plant out of stores after the Michigan Department of Agriculture found *Listeria* bacteria in sandwich spread made from the hotdogs.

Because *Listeria* is found virtually everywhere in the environment — soil, dust, water, sewage — and, unlike most bacteria, can continue to multiply in refrigerator temperatures, these outbreaks were frightening and confounding to all involved. The methods used to inspect the food supply were publicly questioned. How could this happen in what everyone agrees is the world's safest food supply?

On the surface, the issue seems relatively simple: everyone — consumers, producers and researchers — wants a safe and plentiful food supply. So if all agree, why is there so much confusion and controversy surrounding the subject?

Untangling the web of food safety issues requires one to consider all the social, cultural, economic and environmental aspects of producing food — not a small task.

The concept of risk plays an important role in understanding food safety. MSU is home to the National Food Safety and Toxicology Center (NFSTC), which recently hosted a conference on risk analysis for people working on food safety at all levels. Several MAES researchers affiliated with the NFSTC are using risk assessment as a framework to study risks associated with food. Closely related to risk assessment is the idea of risk management — figuring out ways to minimize risk at specific points in the food system. Scientists agree that this is most effective when several links of the food chain, from producer to consumer, are targeted simultaneously.

In 1996, the Food Quality Protection Act (FQPA) was passed unanimously by Congress and signed into law by President Clinton. The FQPA makes dramatic changes in the way the Environmental Protection Agency sets tolerances for pesticide residues on food crops and will likely affect the availability of pesticides for both food and non-food uses. To date, implementation of the FQPA has been slow, and many growers are fearful they may not be able to use certain pesticides that have been essential to producing high-quality crops in amounts that are profitable. Consumers are concerned that, while the implementation process inches along, they and their children are being exposed to levels of pesticides that may be unsafe.



MAES scientists are working to help growers, consumers and industry representatives sort through the legislation and the issues surrounding it.

The MAES has two main areas of emphasis that fall under goal 2: food safety, which includes pre- and postharvest research programs, research to improve the surveillance and monitoring of the food supply, research on microbial food safety and research on chemical food safety; and risk assessment and risk management.

Because the Evaluation Framework and Output Indicators remain constant for each program area under Goal 2, they have been placed before the program areas. Because the Allocated Resources pertain to the entire goal, they have been placed before the program areas as well.

### Evaluation Framework:

All MAES faculty members are required to have a five-year umbrella project. This is evaluated by two independent faculty member reviewers, as well as reviewed by the department chairperson and MAES administrators. Other evaluation tools used will include evidence of scholarly activities, including refereed journal articles; publication of Extension bulletins; the annual departmental performance reviews; and feedback from annual meetings with commodity and industry groups on the satisfactory progress of projects. For some research -- plant breeding for example -- it is more valuable to evaluate the work as it progresses rather than wait until the project is completed. The MAES will use the evaluation tools previously listed to evaluate on-going as well as completed projects.

### Output Indicators:

MAES research program output will be assessed by reviewing the number of publications created from the research, the amount of external funding received, and the number of proposals submitted by the researcher.

## Allocated Resources:

	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Hatch Funds						
Hatch Regular	277,562	289,649	301,498	313,104	324,480	335,629
Multi-State Funds	113,233	113,233	113,233	113,233	113,233	113,233
Other CSREES Funds*	1,414,721	1,414,721	1,414,721	1,414,721	1,414,721	1,414,721
Other Federal Funds*	716,501	716,501	716,501	716,501	716,501	716,501
<b>Total Federal Funds (est.)</b>	<b>2,522,018</b>	<b>2,534,104</b>	<b>2,545,953</b>	<b>2,557,559</b>	<b>2,568,935</b>	<b>2,580,084</b>
State Match for Hatch Funds	390,796	402,882	414,731	426,337	437,713	448,862
Remaining State Appropriations	1,788,660	1,841,957	2,397,453	2,470,213	2,545,733	2,624,087
Self Generated Funds*	150,675	150,675	150,675	150,675	150,675	150,675
Industry Generated Funds*	506,552	506,552	506,552	506,552	506,552	506,552
Other Non-Federal Funds*	105,521	105,521	105,521	105,521	105,521	105,521
<b>Total State Funds (est.)</b>	<b>2,942,204</b>	<b>3,007,587</b>	<b>3,574,933</b>	<b>3,659,298</b>	<b>3,746,195</b>	<b>3,835,698</b>
<b>Total Estimated Funds</b>	<b>5,464,221</b>	<b>5,541,692</b>	<b>6,120,886</b>	<b>6,216,857</b>	<b>6,315,130</b>	<b>6,415,782</b>
<b>Scientist Years</b>	9.5	9.5	10.5	10.5	10.5	10.5

\*Value extracted from the Fiscal Year 1998 Funds and Manpower Report.

## Food Safety

### Key Program Components:

\* Enhancing the economic viability of animal production in Michigan by continuing to register beneficial treatments through the Minor Use Animal Drug Program for the North Central Region.

\* Better understanding the epidemiology of *E. coli* in cattle.

\* Developing new surveillance and monitoring techniques for food.

\* Characterizing new organisms and strains of pathogens that cause food-borne disease.

\* Identifying genetic and molecular traits that have resulted in changes in microbial pathogenicity.

\* Better understanding the nature and mechanism of the action of bacterial toxins.

\* Better understanding the nature and mechanism of endocrine disrupters.

\* Better understanding processing-induced toxicants in food.

## Performance Goals:

### **Short-term Goals**

- \* Provide a rapid response to food safety crises in Michigan.

(Joint with MSU Extension and the colleges of Agriculture and Natural Resources and Veterinary Medicine.)

### **Intermediate-term Goals**

- \* Determining how HACCP (hazard analysis critical control point) programs can be used to control outbreaks of *E. coli* 0157:H7 in cattle operations.

(Multistate, multi-institutional program.)

- \* Develop a rapid test for *Campylobacter jejuni*, a bacterium that is the leading cause of intestinal infection in humans, and other pathogenic microorganisms.

(Multidisciplinary; joint with the colleges of Veterinary Medicine and Agriculture and Natural Resources.)

- \* Develop a rapid, easy-to-use test to determine if meat products have been cooked at the proper temperature for a sufficient amount of time.

(Multidisciplinary.)

- \* Further the understanding of the role of chemical contaminants, micronutrients and bacterial pathogens in gene expression and the etiology of adverse health effects in humans, livestock and wildlife by hiring a scientist who specializes in genomics research and gene array technology.

(Multidisciplinary program; joint with the colleges of Veterinary Medicine, Agriculture and Natural Resources, and Human Medicine.)

### **Long-term Goals**

- \* Continuation of the Minor Use Animal Drug Program for the North Central Region.

(Multistate, multi-institutional, multidisciplinary program.)

- \* Studying the evolution of new food-borne pathogens by hiring a scientist who specializes in evolutionary biology. (*Note: the hiring of the evolutionary biologist is a short-term goal, but the study of the evolution of food-borne pathogens is a long-term goal.*)

(Multidisciplinary program; joint with the Office of the Provost and the College of Agriculture and Natural Resources.)

\* Studying the nature and mechanism of the action of bacterial toxins as pathogenicity factors by hiring a microbial toxicologist. (Note: the hiring of the microbial toxicologist is a short-term goal, but the study of bacterial toxins is a long-term goal.)

(Multidisciplinary program; joint with the Office of the Provost and the College of Agriculture and Natural Resources.)

\* Studying the toxicology of endocrine disrupters, including:

1. Developing *in vitro* bioassays for endocrine disrupters that are predictive of adverse effects *in vivo*.

2. Identifying the molecular determinants responsible for ligand preference and binding affinity differences between species for estrogenic endocrine disrupters.

3. Investigating the effect of developmental exposure to endocrine disrupters on gene expression networks and correlate these changes to adverse physiological effects.

(Multidisciplinary; joint with the Office of the Provost.)

\* Minimizing the formation of toxic compounds by using natural food components as processing ingredients to inhibit the formation of heterocyclic aromatic amines (HAAs) in fried meat products and to improve the oxidative stability of egg powders and dairy products during storage.

(Multidisciplinary.)

\* Examining the interaction of food components during processing and cooking on the generation of toxic compounds, including HAA formation in cooked meats as well as lipid and cholesterol oxidation.

(Multidisciplinary.)

### Internal and External Linkages:

The MAES will work with:

\* The College of Veterinary Medicine to provide a rapid response to food safety crises in Michigan, to develop a rapid test for *Campylobacter jejuni* and other pathogenic microorganisms and to further understand the role of chemical contaminants, micronutrients and bacterial pathogens in gene expression.

\* The College of Human Medicine to further understand the role of chemical contaminants, micronutrients and bacterial pathogens in gene expression.

\* The Office of the Provost to study the evolution of food-borne pathogens, and to better understand the action of bacterial toxins and endocrine disrupters.

\* The College of Agriculture and Natural Resources to develop a rapid test for *Campylobacter jejuni* and other pathogenic microorganisms; to further understand the role of chemical contaminants, micronutrients and bacterial pathogens in gene expression; to provide rapid response to food safety crises in Michigan; and to better understand the action of bacterial toxins and endocrine disrupters.

\* MSU Extension to provide rapid response to food safety crises in Michigan.

### Target Audiences:

MAES programs in food safety are intended to assist agricultural producers and processors, consumers and retailers in Michigan.

### Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

\* Has it been determined how HACCP programs can be used to control outbreaks of *E. coli* 0157:H7 in cattle operations?

\* Has a rapid test for *Campylobacter jejuni* and other pathogenic microorganisms been developed?

\* Has a rapid, easy-to-use test to determine if meat products have been cooked at the proper temperature for a sufficient amount of time been developed?

\* Has a scientist specializing in genomics research and gene array been hired?

\* Is the Minor Use Animal Drug Program for the North Central Region continuing?

\* Has a scientist who specializes in studying new food-borne pathogens been hired?

\* Has a microbial toxicologist with a research focus on the nature and mechanism of the action of bacterial toxins as pathogenicity factors been hired?

\* Have *in vitro* bioassays for endocrine disrupters that are predictive of adverse effects *in vivo* been developed?

\* Have the molecular determinants responsible for ligand preference and binding affinity differences between species for estrogenic endocrine disrupters been identified?

\* Have the effects of developmental exposure to endocrine disrupters on gene expression networks been correlated to adverse physiological effects?

\* Have natural food components been evaluated for their ability to inhibit the formation of heterocyclic aromatic amines (HAAs) in fried meat products and to improve the oxidative stability of egg powders and dairy products during storage?

\* Has the interaction of food components during processing and cooking, including the factors influencing HAA formation in bacon and ground beef patties, been characterized?

\* Has a rapid response to food safety crises in Michigan been provided?

## **Risk Assessment and Risk Management**

### **Key Program Components:**

\* Enhancing food safety in Michigan by assisting growers, processors and retailers in implementing HACCP (hazard analysis critical control points) programs.

\* Better understanding the social aspects of risk analysis.

### **Performance Goals:**

#### **Short-term Goals**

\* Hold an annual conference on food safety risk assessment.

(Multistate, multidisciplinary; joint with the Office of the Provost, MSU Extension, and the colleges of Veterinary Medicine and Agriculture and Natural Resources.)

#### **Intermediate-term Goals**

\* Introduce and implement the Total Quality Management (TQM) processes for use in managing milking cows, dry cows and cull cows, including using TQM to monitor and evaluate milking and dry cows through the use of drug record systems and development of treatment protocols; determining the usefulness of health management practices while monitoring pathogens in cull cows prior to and at slaughter; and developing safe, effective alternatives for treating and controlling diseases.

(Multidisciplinary program; joint program with MSU Extension, and the colleges of Veterinary Medicine and Agriculture and Natural Resources.)

## **Long-term Goals**

\* To further the study of the process and practice of risk analysis and the uses of microbiological, epidemiological and sociological information in that process two scientists who specialize in microbiological and sociological aspects of microbial risk assessment will be hired.

(Multidisciplinary program; joint program with the colleges of Social Science, Veterinary Medicine, and Agriculture and Natural Resources.)

\* Hiring a scientist who specializes in the risk communication process, including risk perception, risk reduction and the networks of risk communication.

(Multidisciplinary program; joint program with the colleges of Social Science, Communication Arts and Sciences, and Agriculture and Natural Resources, and MSU Extension.)

## **Internal and External Linkages:**

The MAES is working with:

\* MSU Extension to introduce the TQM process to manage milking cows, dry cows and cull cows; to hold an annual food safety risk assessment conference; and to hire a risk communications scientist.

\* The MSU College of Veterinary Medicine to hold an annual conference on food safety risk assessment; to introduce the TQM process to manage milking cows, dry cows and cull cows; and to hire two risk assessment scientists.

\* The Office of the Provost to hold an annual food safety risk assessment conference.

\* The College of Social Science to hire two risk assessment scientists and a risk communication scientist.

\* The College of Communication Arts and Sciences to hire a risk communication scientist.

\* The College of Agriculture and Natural Resources to introduce the TQM process to manage milking cows, dry cows and cull cows; to hold an annual food safety risk assessment conference; to hire a risk communications scientist; and to hire two risk assessment scientists.

## **Target Audiences:**

MAES programs in food safety and risk assessment and management are intended to assist agricultural producers and processors, consumers and retailers in Michigan.

## Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

- \* Is a conference on food safety risk assessment being held annually?
- \* Has the Total Quality Management (TQM) process for use in managing milking cows, dry cows and cull cows been implemented?
- \* Have two scientists who specialize in microbiological and sociological aspects of microbial risk assessment been hired?
- \* Has a scientist who specializes in risk communication been hired?



# Goal 3: A Healthy, Well Nourished Population

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## Statement of Issue:

The United States is a country of various religions, races, values and political viewpoints. But beneath all the contrasts is a universal: everyone needs to eat. Food and its preparation and consumption are part of a complex web of social, psychological and physical rituals in society. Food advertising is everywhere, and placing products in movies and television show has become a full-time business for marketing representatives.

What people don't eat is just as important as what they do. After providing dietary advice for more than a century, the U.S. government developed "Dietary Guidelines for Americans" in 1980. In 1990, the "Dietary Guidelines" started to recommend specific numbers regarding food — for example, total fat consumption should be 30 percent or less of total calories consumed and saturated fat should be less than 10 percent of total calories.

Though the link between poor diet and health problems such as hypertension, obesity, some cancers and heart disease is well documented (one government report estimates that diet-related diseases cost society more than \$250 billion annually in medical expenses and lost productivity), the majority of people in the United States still eat too much fat and sugar and not enough fruit and vegetables.

Finding the answers to the immediate questions of "Why?" and "How can this be changed?" fuels the research of many MAES scientists. The MAES has one main thrust in this area -- food and nutrition.

Because the Evaluation Framework and Output Indicators remain constant for each program area under Goal 3, they have been placed before the program areas. Because the Allocated Resources pertain to the entire goal, they have been placed before the program areas as well.

## Evaluation Framework:

All MAES faculty members are required to have a five-year umbrella project. This is evaluated by two independent faculty member reviewers, as well as reviewed by the department chairperson and MAES administrators. Other evaluation tools used will include evidence of scholarly activities, including refereed journal articles; publication of Extension bulletins; the annual departmental performance reviews; and feedback from annual meetings with commodity and industry groups on the satisfactory progress of projects. For some research -- plant breeding for example -- it is more valuable to evaluate the work as it progresses rather than wait until the project is completed. The MAES will use the evaluation tools previously listed to evaluate on-going as well as completed projects.

## Output Indicators:

MAES research program output will be assessed by reviewing the number of publications created from the research, the amount of external funding received, and the number of proposals submitted by the researcher.

## Allocated Resources:

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>	<u>FY 2004</u>
Hatch Funds						
Hatch Regular	13,254	13,832	14,397	14,952	15,495	16,027
Multi-State Funds	49,332	49,332	49,332	49,332	49,332	49,332
Other CSREES Funds*	208,739	208,739	208,739	208,739	208,739	208,739
Other Federal Funds*	143,715	143,715	143,715	143,715	143,715	143,715
<b>Total Federal Funds (est.)</b>	<b>415,040</b>	<b>415,618</b>	<b>416,183</b>	<b>416,738</b>	<b>417,281</b>	<b>417,813</b>
State Match for Hatch Funds	62,587	63,164	63,729	64,284	64,827	65,359
Remaining State Appropriations	919,684	948,575	1,178,362	1,215,070	1,252,907	1,291,907
Self Generated Funds*	4,470	4,470	4,470	4,470	4,470	4,470
Industry Generated Funds*	249,089	249,089	249,089	249,089	249,089	249,089
Other Non-Federal Funds*	8,016	8,016	8,016	8,016	8,016	8,016
<b>Total State Funds (est.)</b>	<b>1,243,846</b>	<b>1,273,314</b>	<b>1,503,666</b>	<b>1,540,929</b>	<b>1,579,310</b>	<b>1,618,842</b>
<b>Total Estimated Funds</b>	<b>1,658,886</b>	<b>1,688,932</b>	<b>1,919,849</b>	<b>1,957,667</b>	<b>1,996,591</b>	<b>2,036,655</b>
<b>Scientist Years</b>	5.1	5.1	5.1	5.1	5.1	5.1

\*Value extracted from the Fiscal Year 1998 Funds and Manpower Report.

## Food and Nutrition

### Key Program Components:

- \* Developing dietary profiles and food consumption patterns of populations.
- \* Enhancing the MSU Food and Nutrition Database Research Center (FNDRC).
- \* Examining the link between diet and chronic diseases such as cancer and allergies.

## Performance Goals:

### **Intermediate-term Goals**

\* Work with community groups to evaluate the nutritional status and food behaviors of adolescents, young adults and limited-income people.

(Multistate; joint program with MSU Extension, and the colleges of Human Ecology and Agriculture and Natural Resources.)

### **Long-term Goals**

\* Continuing to add information to the FNDRC and using that information to perform original research, collaborate with scientists at other institutions, and assist private industry and government organizations.

(Multi-institutional; joint with the colleges of Human Ecology and Agriculture and Natural Resources.)

\* Determine the efficacy of a variety of plant foods and phytochemicals to reduce colon cancer in animal models of colon carcinogenesis and measure the effect of the most promising dietary anticarcinogens on colonic epithelial cell proliferation, differentiation and programmed cell death.

(Joint with the colleges of Human Ecology and Agriculture and Natural Resources.)

\* Determine if soy phytochemicals can reduce colon carcinogenesis in rats and can reduce colon cancer risk in humans, as well as the relative potency of genistein and genistein conjugates in reduction of colon carcinogenesis in rats and how genistein inhibits cell growth and/or enhances cell differentiation.

(Multistate, multidisciplinary; joint with the colleges of Human Ecology and Agriculture and Natural Resources.)

\* Determine the factors affecting the bioavailability of iron and zinc to maximize health and disease prevention, as well as constructing models of metabolism to predict optimal vitamin and mineral intakes.

(Multidisciplinary; joint with the colleges of Human Ecology, Agriculture and Natural Resources, and Natural Science.)

\* To develop animal models of food-related allergic diseases and investigate the mechanistic basis of allergic responses to food constituents, a scientist who specializes in experimental immunology of food allergens will be hired. (Note: *the hiring of the experimental immunologist is a short-term goal, but the study of food-related allergic diseases is a long-term goal.*)

(Multidisciplinary program; joint with the colleges of Human Ecology and Agriculture and Natural Resources.)

## Internal and External Linkages:

The MAES will work with:

- \* MSU Extension to evaluate the nutritional status and food behaviors of adolescents, young adults and limited-income people.
- \* The College of Human Ecology to evaluate the nutritional status and food behaviors of adolescents, young adults and limited-income people; to determine the efficacy of phytochemicals to reduce colon cancer; to continue to add information to the FNDRC; to determine if soy phytochemicals and genistein can reduce colon cancer; to determine the factors affecting the bioavailability of iron and zinc to maximize health and disease prevention; to hire a scientist who specializes in experimental immunology of food allergens.
- \* The College of Natural Science to determine the factors affecting the bioavailability of iron and zinc to maximize health and disease prevention.
- \* The College of Agriculture and Natural Resources to evaluate the nutritional status and food behaviors of adolescents, young adults and limited-income people; to determine the efficacy of phytochemicals to reduce colon cancer; to continue to add information to the FNDRC; to determine if soy phytochemicals and genistein can reduce colon cancer; to determine the factors affecting the bioavailability of iron and zinc to maximize health and disease prevention; to hire a scientist who specializes in experimental immunology of food allergens.

## Target Audiences:

MAES programs in food safety and risk assessment and management are intended to assist agricultural producers and processors, consumers and retailers in Michigan.

## Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

- \* Have the nutritional status and food behaviors of adolescents, young adults and limited-income people been evaluated?
- \* Has information been added to the FNDRC, and has it been used to perform original research, collaborate with scientists at other institutions, and assist pri-

vate industry and government organizations?

\* Has the efficacy of a variety of plant foods and phytochemicals to reduce colon cancer in animal models of colon carcinogenesis been determined?

\* Has the effect of the most promising dietary anticarcinogens on colonic epithelial cell proliferation, differentiation and programmed cell death been measured?

\* Has it been determined if soy phytochemicals can reduce colon carcinogenesis in rats and colon cancer risk in humans?

\* Have the relative potency of genistein and genistein conjugates in reduction of colon carcinogenesis in rats and how genistein inhibits cell growth and/or enhances cell differentiation been determined?

\* Have the factors affecting the bioavailability of iron and zinc to maximize health and disease prevention been determined?

\* Have models of metabolism to predict optimal vitamin and mineral intakes been constructed?

\* Has a scientist who specializes in experimental immunology of food allergens been hired to develop animal models of food-related allergic diseases and investigate the mechanistic basis of allergic responses to food constituents?

# Goal 4: Greater Harmony Between Agriculture and the Environment

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## Statement of Issue:

Producing crops is all about management. By adding supplementary fertilizer, tilling the soil, irrigating fields and controlling pests, farmers subtly compel the ecosystem to conform to their desires and produce more wheat or corn or beans than would have been grown with no additions. In the recent past, growers have been criticized for exerting too much pressure on the soil, forcing it to give larger and larger yields until, exhausted, it simply could not achieve any higher level of production.

In the mid-1980s, the phrase "sustainable agriculture" became commonplace in discussions between growers and researchers. Though it can mean many things to many people, most would agree that it refers to an agricultural system that provides growers with a good income, provides consumers with a dependable, safe food supply and has minimal negative impact on the environment. It means understanding the various systems well enough to manage and integrate them.

The MAES believes that it is important for people to know that there is not just one sustainable agriculture "program" at Michigan State University that includes some projects and excludes others. Biological integration is a theme that runs through many MAES programs and is important to everyone.

The MAES has two main areas of focus under goal 4: land use and cover, and environmental stewardship.

Because the Evaluation Framework and Output Indicators remain constant for each program area under Goal 4, they have been placed before the program areas. Because the Allocated Resources pertain to the entire goal, they have been placed before the program areas as well.

## Evaluation Framework:

All MAES faculty members are required to have a five-year umbrella project. This is evaluated by two independent faculty member reviewers, as well as reviewed by the department chairperson and MAES administrators. Other evaluation tools used will include evidence of scholarly activities, including refereed journal articles; publication of Extension bulletins; the annual departmental performance reviews; and feedback from annual meetings with commodity and industry groups on the satisfactory progress of projects. For some research -- plant breeding for example -- it is more valuable to evaluate the work as it progresses rather than wait until the project is completed. The MAES will use the evaluation tools previously listed to evaluate on-going as well as completed projects.

## Output Indicators:

MAES research program output will be assessed by reviewing the number of publications created from the research, the amount of external funding received, and the number of proposals submitted by the researcher.

## Allocated Resources:

	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
<b>Hatch Funds</b>						
Hatch Regular	522,656	545,416	567,721	589,580	611,007	631,996
Multi-State Funds	94,679	94,679	94,679	94,679	94,679	94,679
<b>Other CSREES Funds*</b>	494,999	494,999	494,999	494,999	494,999	494,999
<b>Other Federal Funds*</b>	1,777,501	1,777,501	1,777,501	1,777,501	1,777,501	1,777,501
<b>Total Federal Funds (est.)</b>	2,889,834	2,912,595	2,934,900	2,956,759	2,978,186	2,999,175
<b>State Match for Hatch Funds</b>	617,335	640,095	662,400	684,259	705,686	726,675
<b>Remaining State Appropriations</b>	3,498,195	3,598,901	4,203,766	4,327,892	4,456,829	4,590,716
<b>Self Generated Funds*</b>	416,391	416,391	416,391	416,391	416,391	416,391
<b>Industry Generated Funds*</b>	786,506	786,506	786,506	786,506	786,506	786,506
<b>Other Non-Federal Funds*</b>	1,402,725	1,402,725	1,402,725	1,402,725	1,402,725	1,402,725
<b>Total State Funds (est.)</b>	6,721,152	6,844,618	7,471,788	7,617,773	7,768,138	7,923,013
<b>Total Estimated Funds</b>	9,610,987	9,757,213	10,406,688	10,574,532	10,746,323	10,922,188
<b>Scientist Years</b>	28.5	28.5	28.5	28.5	28.5	28.5

\*Value extracted from the Fiscal Year 1998 Funds and Manpower Report.

## Land Use and Cover

### Key Program Components:

\* Capture patterns of change using new earth-observing satellites; *in situ* measurements such as weather, climate and water quality; and sociodemographic data such as digital census databases, surveys and digital atlases.

\* Understand the fundamental processes driving change through field-based analyses and survey and research efforts, which provide on-the-ground insights.

\* Synthesize, assess and evaluate using models and report cards in response to state, regional, national and international policy needs.

\* Disseminate information using computational and visualization technology for managing complex ecological and landscape information from global to local scales.

\* Determine new methods of phytoremediation and bioremediation.

\* Better understand microbial ecology.

## Performance Goals:

### **Short-term Goals**

\* Develop an environmental research initiative.

(Multidisciplinary; joint with the colleges of Natural Science, Agriculture and Natural Resources, Social Science and Engineering, the Office of the Vice President for Research and Graduate Studies, and MSU Extension.)

### **Intermediate-term Goals**

\* Link land-use initiatives universitywide.

(Multidisciplinary; joint with the colleges of Natural Science, Agriculture and Natural Resources, Social Science and Engineering, the Office of the Vice President for Research and Graduate Studies, and MSU Extension.)

### **Long-term Goals**

\* Establish a research program in land use and land cover change that is a central element of MSU's environmental research initiative.

(Multidisciplinary; joint with the colleges of Natural Science, Agriculture and Natural Resources, Social Science and Engineering, the Office of the Vice President for Research and Graduate Studies, and MSU Extension.)

\* Extend the research and outreach under the Long-term Ecological Research (LTER) project regionally through remote sensing.

(Multidisciplinary; multistate; joint with MSU Extension and the colleges of Natural Science, Agriculture and Natural Resources, and Social Science.)

\* Develop multistate alliances with other land-grant institutions and state and federal agencies as a NASA-supported regional earth science applications center for resource management using remote sensing.

(Multistate; multidisciplinary; joint with the Office of the Vice President for Research and Graduate Studies, MSU Extension, and the colleges of Social Science, Agriculture and Natural Resources, Natural Science, and Engineering.)

\* Develop a remote sensing receiving station.

(Multidisciplinary; joint with the colleges of Social Science and Agriculture and Natural Resources.)



\* Develop a research program in phytoremediation by hiring a scientist who specializes in this area.

(Multidisciplinary; joint with the Office of the Provost and the College of Agriculture and Natural Resources.)

\* Understand mechanistic interactions of organic contaminants with organo-modified clays used to reduce environmental contamination.

(Multidisciplinary; joint with the colleges of Natural Science and Agriculture and Natural Resources.)

\* Discover and characterize novel anaerobic microbial processes that degrade hazardous waste, especially petroleum compounds and chlorinated chemicals.

(Multidisciplinary; joint with the colleges of Natural Science, Agriculture and Natural Resources, and Engineering.)

\* Determine the structure and composition of soil microbial communities and how those communities are influenced by environmental forces.

(Multidisciplinary; joint with the colleges of Natural Science, Agriculture and Natural Resources, and Engineering.)

### Internal and External Linkages:

The MAES is working with:

\* The College of Natural Science to establish a research program in land use and cover; to establish an environmental research initiative; to link land-use initiatives universitywide; to extend the research and outreach under the LTER project through remote sensing; to develop multistate alliances as a NASA-supported regional earth science applications center; to understand the interactions of organic contaminants with organoclays; to characterize novel anaerobic microbial processes that degrade hazardous waste; and to determine the structure and composition of soil microbial communities.

\* The College of Social Science to establish a research program in land use and cover; to establish an environmental research initiative; to link land-use initiatives universitywide; to extend the research and outreach under the LTER project through remote sensing; to develop multistate alliances as a NASA-supported regional earth science applications center; and to develop a remote sensing receiving station.

\* The College of Engineering to establish a research program in land use and cover; to establish an environmental research initiative; to link land-use initiatives universitywide; to develop multistate alliances as a NASA-supported regional earth science applications center; to characterize novel anaerobic microbial processes that degrade hazardous waste; and to determine the structure and composition of soil microbial communities.

\* MSU Extension to establish a research program in land use and cover; to establish an environmental research initiative; to link land-use initiatives universitywide; to extend the research and outreach under the LTER project through remote sensing; and to develop multistate alliances as a NASA-supported regional earth science applications center.

\* The Office of the Vice President for Research and Graduate Studies to establish a research program in land use and cover; to establish an environmental research initiative; to link land-use initiatives universitywide; and to develop multistate alliances as a NASA-supported regional earth science applications center.

\* The Office of the Provost to hire a researcher who specializes in phytoremediation.

\* The College of Agriculture and Natural Resources to establish a research program in land use and cover; to extend the research and outreach under the LTER project through remote sensing; to develop multistate alliances as a NASA-supported regional earth science applications center; to understand the interactions of organic contaminants with organoclays; to characterize novel anaerobic microbial processes that degrade hazardous waste; to determine the structure and composition of soil microbial communities, to develop a remote sensing receiving station; and to hire a researcher who specializes in phytoremediation.

### Target Audiences:

MAES programs in land use and land cover and environmental stewardship are intended to assist agricultural producers, processors and retailers, natural resources producers and processors, Michigan wildlife, consumers, those who use the state's natural resources for recreation and others in the state interested in this area.

### Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

\* Has a research program in land use and land cover change been established as a central element of MSU's environmental research initiative?

\* Has the research and outreach under the LTER been extended regionally through remote sensing?

\* Have multistate alliances been developed with other land-grant institutions and state and federal agencies as a NASA-supported regional earth science applications center for resource management using remote sensing?

- \* Has a remote sensing receiving station been developed?
- \* Has a researcher who specializes in phytoremediation been hired?
- \* Are the mechanistic interactions of organic contaminants with organo-modified clays being used to reduce environmental contamination?
- \* Have novel anaerobic microbial processes that degrade hazardous waste, especially petroleum compounds and chlorinated chemicals, been characterized?
- \* Have the structure and composition of soil microbial communities and how those communities are influenced by environmental forces been determined?

## **Environmental Stewardship**

### **Key Program Components:**

- \* Continuing the Long-term Ecological Research (LTER) Project and the Living Field Lab at the Kellogg Biological Station with the aim of enhancing the understanding of biological interactions in the environment.
- \* Better understanding of what it takes to make agriculture and natural resources sustainable.
- \* Using geographic information system information, remote sensing and computer modeling to manage ecosystems, including fish populations, forests and insects.
- \* Managing the white-tailed deer population in Michigan.

### **Performance Goals:**

#### **Intermediate-term Goals**

- \* To develop an international, comparative study of the role of farm, rural development and environmental groups in agricultural research and development policy.

(Multi-institutional, multistate.)

#### **Long-term Goals**

- \* Continuing to use the National Science Foundation-funded Long-term Ecological Research (LTER) Project to host a number of shorter term projects on ecosystem management, including:

1. Better understanding seasonal and annual fluxes in soil microbial activity in response to crop diversity and management.

2. Quantifying and understanding crop selection and management factors that control seasonal pulsing of soil nitrate in a field crop rotation.

3. Altering crop sequence, cover crop use and crop management of key Michigan field crop rotations for greater productivity, lowered environmental impact and greater stability across soil variability.

4. Translating and adapting basic agroecological information of the LTER project through the Living Field Laboratory and into working form for use by Michigan agricultural professionals and farmers.

(Multistate; multidisciplinary; joint with MSU Extension and the colleges of Natural Science and Agriculture and Natural Resources.)

\* To develop a comprehensive database of Michigan agricultural, rural development and environmental groups that would identify and clarify the policy, technology and organizational issues of these groups.

(Multidisciplinary, multi-institutional; joint with MSU Extension and the College of Agriculture and Natural Resources.)

\* To promote the establishment of a network among MAES and North Central Region social, plant, and animal scientists who work with and/or are concerned about the contribution of these groups to the future of agriculture and natural resources in Michigan and the region.

(Multidisciplinary, multistate; joint with the colleges of Natural Science and Agriculture and Natural Resources.)

\* Develop agricultural production systems that are highly productive and profitable as well as environmentally sustainable, including identifying and characterizing sustainable crop and cover crop rotations having sequences of crops and management of nutrient inputs leading to improved soil quality, efficient nutrient flow and crop-pest balance while maintaining yields; developing water table management strategies using subirrigation for higher crop yields and more efficient nutrient use; improving nutrient flow systems for dairy, beef and sheep producers using intensively managed rotational grazing coupled, where appropriate, with manure composting.

(Multidisciplinary, multistate; joint with the Michigan Department of Natural Resources, the Michigan Department of Environmental Quality, the Michigan Department of Agriculture, and the College of Agriculture and Natural Resources.)

\* Study ecosystem management, including:

1. Test the utility of GIS analysis for the measurement and management of biodiversity and endangered species habitats.

2. Evaluate the probable economic and social impacts of ecosystem management alternatives in a spatially explicit framework.

3. Apply GIS and non-market evaluation techniques in the assessment and valuation of risk.

4. Analyze the cumulative effects of land use and land management activities and identify options for remediation.

(Multistate, multidisciplinary; joint with the colleges of Natural Science and Agriculture and Natural Resources, and MSU Extension.)

\* Continuation of the Partnership for Ecosystems Research and Management (PERM) program. PERM began as a formal partnership between Michigan State University and the Fisheries and Wildlife divisions of the Michigan Department of Natural Resources (DNR). This partnership was established on Earth Day, April 22, 1993, to enhance the joint ability of the university and Department of Natural Resources to work with other stakeholders to identify significant ecosystem problems and conduct research toward their solution. The original agreement has been amended to include the DNR's Forest Management Division, and a new agreement has added the Great Lakes Fishery Commission and the Great Lakes Science Center (U.S. Geological Survey) as partners. PERM objectives include: augment regional capability for ecosystem-level applied research; provide outreach services to management agencies; and serve as a liaison between management agencies to facilitate cooperative research on high-priority problems.

(Multidisciplinary; joint with the Michigan departments of Agriculture and Natural Resources, MSU Extension, and the College of Agriculture and Natural Resources.)

\* Use management models to study Great Lakes fisheries, including:

1. Developing an understanding of the link between salmonid and other predators and their forage fish and of the spatial movements of these fish.

2. Quantifying the importance of uncontrollable variations in the environment; exploring the connections among species; and developing fishery models for use in making management decisions.

(Multidisciplinary; joint with the Department of Natural Resources and the College of Agriculture and Natural Resources.)

\* Continue to gather information on the ecology -- particularly social structure and movement patterns -- of white-tailed deer in Michigan, including:

1. Documenting the behavior of deer at fall baiting and winter feeding sites.

2. Developing generalized population dynamics models that can be applied to management plans for wild populations, developing methodologies to estimate demographic parameters (e.g., population size, survival rates, sex and age distribution) for wild populations, and evaluating existing population estimation techniques and models as they can be applied to wild populations.

(Multidisciplinary; joint with the Department of Natural Resources, MSU Extension, and the College of Social Science.)

\* Determine the extent, timing and frequency of anomalous climate events using long-term observation resources in the North Central Region.

(Multidisciplinary; joint with the College of Natural Science.)

\* Analyze the climate and soils from the perspective of agricultural landscape structure and diversity in the North Central Region and determine the relationships of climate and soils to agricultural production, including spatial and temporal analysis of climate, soils and crop characteristics, and analysis and interpretation of the interrelationships between climate, soils and crop production.

(Multidisciplinary; joint with the College of Natural Science.)

\* Examine several large-scale processes involving pest and beneficial insects. They include regional crop and forest production, biological diversity within agroecosystems and long-range transport of insects in the atmosphere. There are three key aspects required to address each of these areas: the development principles of pest management within an ecosystem management framework; the application of scientific visualization technologies and principles to provide a synthesis of understanding of the processes involved in managing pests in simple and complex ecosystems; and the use of data management and data mining technologies to model specific case studies related to pest management in selected ecosystems at different spatial and temporal scales.

(Multidisciplinary; joint with the colleges of Natural Science and Agriculture and Natural Resources.)

### Internal and External Linkages:

The MAES will work with:

\* The College of Natural Science to continue to use the LTER site to host projects; to promote the establishment of a North Central regional network of scientists concerned about the future of agriculture and natural resources; to study ecosystem management; to study anomalous climate events; to analyze the climate and soils from an agricultural landscape structure position; and to examine large-scale processes involving pests and beneficial insects.

\* MSU Extension to continue to use the LTER site to host projects; to develop a database of Michigan agricultural, rural development and environmental groups; to study ecosystem management; to continue the PERM program; and to continue to gather information on the ecology -- particularly the social structure and movement patterns -- of white-tailed deer in Michigan.

\* The Michigan Department of Natural Resources to develop agricultural production systems that are highly productive, profitable and environmentally sustainable; to use management models to study Great Lakes fisheries; to continue the PERM program; and to continue to gather information on the ecology -- particularly the social structure and movement patterns -- of white-tailed deer in Michigan.

\* The Michigan Department of Environmental Quality to develop agricultural production systems that are highly productive, profitable and environmentally sustainable.

\* The Michigan Department of Agriculture to develop agricultural production systems that are highly productive, profitable and environmentally sustainable; and to examine large-scale processes involving pests and beneficial insects.

\* The College of Agriculture and Natural Resources to continue the PERM program; to continue to use the LTER site to host projects; to promote the establishment of a North Central regional network of scientists concerned about the future of agriculture and natural resources; to study ecosystem management; to study anomalous climate events; to analyze the climate and soils from an agricultural landscape structure position; to examine large-scale processes involving pests and beneficial insects; to develop a database of Michigan agricultural, rural development and environmental groups; to develop agricultural production systems that are highly productive, profitable and environmentally sustainable; to use management models to study Great Lakes fisheries; and to continue to gather information on the ecology -- particularly the social structure and movement patterns -- of white-tailed deer in Michigan.

\* The College of Social Science to continue to gather information on the ecology -- particularly the social structure and movement patterns -- of white-tailed deer in Michigan.

### Target Audiences:

MAES programs in land use and land cover and environmental stewardship are intended to assist agricultural producers, processors and retailers, natural resources producers and processors, Michigan wildlife, consumers, those who use the state's natural resources for recreation and others in the state interested in this area.

### Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

\* Is the National Science Foundation-funded Long-term Ecological Research (LTER) Project continuing to be used to host a number of shorter term projects on ecosystem management?

\* Is there a better understanding of seasonal and annual fluxes in soil microbial activity in response to crop diversity and management?

- \* Are crop selection and management factors that control seasonal pulsing of soil nitrate in a field crop rotation understood?
- \* Have crop sequence, cover crop use and crop management of key Michigan field crop rotations been altered for greater productivity, lowered environmental impact and greater stability across soil variability?
- \* Has basic agroecological information from the LTER project been transferred and adapted through the Living Field Laboratory and into working form for use by Michigan agricultural professionals and farmers?
- \* Has a comprehensive database of Michigan agricultural, rural development and environmental groups that would identify and clarify the policy, technology and organizational issues of these groups been developed?
- \* Has a network been established among MAES and North Central Region social, plant, and animal scientists who work with and/or are concerned about the contribution of these groups to the future of agriculture and natural resources in Michigan and the region?
- \* Has an international comparative study of the role of farm, rural development and environmental groups in agricultural research and development policy been developed?
- \* Have agricultural production systems that are highly productive, profitable and environmentally sustainable been developed?
- \* Have sustainable crop and cover crop rotations been developed that have sequences of crops and management of nutrient inputs leading to improved soil quality, efficient nutrient flow and crop-pest balance and maintain yields?
- \* Have water table management strategies using subirrigation for higher crop yields and more efficient nutrient use been developed?
- \* Have nutrient flow systems been developed for dairy, beef and sheep producers using intensively managed rotational grazing coupled, where appropriate, with manure composting?
- \* Is GIS analysis being used for the measurement and management of biodiversity and endangered species habitats?
- \* Have the probable economic and social impacts of ecosystem management alternatives in a spatially explicit framework been evaluated?
- \* Have GIS and non-market evaluation techniques been used in the assessment and valuation of risk?
- \* Is the Partnership for Ecosystems Research and Management (PERM) program continuing?
- \* Have the cumulative effects of land use and land management activities been analyzed and options for remediation identified?
- \* Has an understanding of the link between salmonid and other predators and their forage fish and of the spatial movements of these fish been developed?



\* Has the importance of uncontrollable variations in the environment been quantified?

\* Has exploration of the connections among species been quantified?

\* Have fishery models for use in making management decisions been developed?

\* Is information on the ecology -- particularly the social structure and movement patterns -- of white-tailed deer in Michigan being gathered?

\* Is the behavior of deer at fall baiting and winter feeding sites being documented?

\* Have generalized population dynamics models that can be applied to management plans for wild populations and methodologies to estimate demographic parameters (e.g., population size, survival rates, sex and age distribution) for wild populations been developed, and have existing population estimation techniques and models as they can be applied to wild populations been evaluated?

\* Have the extent, timing and frequency of anomalous climate events been determined using long-term observation resources in the North Central Region?

\* Have the climate and soils in the North Central Region been analyzed from the perspective of agricultural landscape structure and diversity; have the relationships of climate and soils on agricultural production, including spatial and temporal analysis of climate, soils and crop characteristics, been determined; and have the interrelationships between climate, soils and crop production been analyzed?

\* Have the several large-scale processes involving pest and beneficial insects been analyzed?

# Goal 5: Enhanced Economic Opportunity and Quality of Life for Americans

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## Statement of Issue:

Rural families and communities and economic development have always been part of the MAES mission. Critical issues such as quality child care, safe housing, good schools and nutritious food challenge all Michigan citizens. Community organizations and policy-makers need information on best practices for making and evaluating program decisions, as well as training to allow them to be the most effective leaders possible.

Development is linked to economic growth and prosperity, something to which everyone in Michigan aspires. At the same time, everyone also wants a clean, healthy environment, with plentiful food and water for all creatures. And natural areas for wildlife and vegetation, room to get away, green areas for children to play in and enough room for everyone to live comfortably.

To enhance their economic opportunities, some agricultural producers have become business entrepreneurs, which offers a new set of challenges, in addition to those of growing food.

The MAES is committed to these areas and has four main areas of emphasis under this goal: children, youth, families and communities; farm management; natural resources initiatives; and leadership programs.

Because the Evaluation Framework and Output Indicators remain constant for each program area under Goal 5, they have been placed before the program areas. Because the Allocated Resources pertain to the entire goal, they have been placed before the program areas as well.

## Evaluation Framework:

All MAES faculty members are required to have a five-year umbrella project. This is evaluated by two independent faculty member reviewers, as well as reviewed by the department chairperson and MAES administrators. Other evaluation tools used will include evidence of scholarly activities, including refereed journal articles; publication of Extension bulletins; the annual departmental performance reviews; and feedback from annual meetings with commodity and industry groups on the satisfactory progress of projects. For some research -- plant breeding for example -- it is more valuable to evaluate the work as it progresses rather than wait until the project is completed. The MAES will use the evaluation tools previously listed to evaluate on-going as well as completed projects.

## Output Indicators:

MAES research program output will be assessed by reviewing the number of publications created from the research, the amount of external funding received, and the number of proposals submitted by the researcher.

## Allocated Resources:

	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Hatch Funds						
Hatch Regular	424,159	442,630	460,730	478,471	495,856	512,893
Multi-State Funds	77,525	77,525	77,525	77,525	77,525	77,525
Other CSREES Funds*	137,376	137,376	137,376	137,376	137,376	137,376
Other Federal Funds*	91,347	91,347	91,347	91,347	91,347	91,347
<b>Total Federal Funds (est.)</b>	<b>730,407</b>	<b>748,879</b>	<b>766,979</b>	<b>784,720</b>	<b>802,105</b>	<b>819,142</b>
State Match for Hatch Funds	501,684	520,155	538,255	555,996	573,381	590,418
Remaining State Appropriations	2,068,745	2,127,386	2,688,713	2,767,781	2,850,109	2,935,777
Self Generated Funds*	7,754	7,754	7,754	7,754	7,754	7,754
Industry Generated Funds*	171,741	171,741	171,741	171,741	171,741	171,741
Other Non-Federal Funds*	188,238	188,238	188,238	188,238	188,238	188,238
<b>Total State Funds (est.)</b>	<b>2,938,161</b>	<b>3,015,274</b>	<b>3,594,700</b>	<b>3,691,509</b>	<b>3,791,223</b>	<b>3,893,927</b>
<b>Total Estimated Funds</b>	<b>3,668,568</b>	<b>3,764,153</b>	<b>4,361,679</b>	<b>4,476,229</b>	<b>4,593,327</b>	<b>4,713,069</b>
<b>Scientist Years</b>	16.1	16.1	16.1	16.1	16.1	16.1

\*Value extracted from the Fiscal Year 1998 Funds and Manpower Report.

## Children, Youth, Families and Communities

### Key Program Components:

\* The Coalition for Children, Youth Families and Communities has been established. With a coordinating body of representatives from Michigan State University and community partners that share a commitment to children, youth, families and communities, the coalition will sponsor multidisciplinary teams, projects and initiatives; manage a clearinghouse for statewide information on expertise and projects; translate scientific knowledge into educational programs and materials that the public can understand and use; allocate resources and help set priorities for social, economic, developmental and family research, extension and outreach; and identify strengths, gaps in resources and expertise, and new directions.

## Performance Goals:

Through the Coalition for Children, Youth, Families and Communities, the MAES will support new directions in research, problem solving and multidisciplinary outreach scholarship on children, youth and families, including the following goals:

### **Short-term Goals**

\* Creating new programs for professional development and networking, including forums, grantsmanship intelligence, networking faculty with foundations, partnerships with university programs, and expertise for planning and evaluation. (*Note: this goal is short-term but is on-going.*)

(Multi-institutional, multidisciplinary; joint with the colleges of Social Science, Human Ecology, and Agriculture and Natural Resources, the Family Independence Agency, the Michigan Department of Community Health, MSU Extension, and the Office of the Provost.)

### **Intermediate-term Goals**

\* Promoting and coordinating research on diversity to address issues of migrant and seasonal laborers and their families; and community capacity to meet needs of diverse children, youth and families.

(Multi-institutional, multidisciplinary; joint with the colleges of Social Science, Human Ecology, and Agriculture and Natural Resources, the Michigan Department of Community Health, MSU Extension, the Michigan Department of Agriculture, and the Office of the Provost.)

\* Securing a commitment from the MAES, MSU Extension and the Office of the Provost for on-going funding and leadership for the Coalition for Children, Youth, Families and Communities.

(Multidisciplinary, multi-institutional; joint with MSU Extension and the Office of the Provost.)

### **Long-term Goals**

\* Developing analytical frameworks and research on youth assets and resiliency and community support.

(Multi-institutional, multidisciplinary; joint with the colleges of Social Science, Human Ecology, Agriculture and Natural Resources, and Education, the Family Independence Agency, the Michigan Department of Community Health, MSU Extension, and the Office of the Provost.)

\* Promoting new analytical frameworks and methodology for research on social capital in domestic and international contexts.

(Multi-institutional, multidisciplinary; joint with the colleges of Social Science, Human Ecology, Agriculture and Natural Resources, and Education, the Family Independence Agency, MSU Extension, and the Office of the Provost.)

## Internal and External Linkages:

The MAES will work with the colleges of Social Science, Agriculture and Natural Resources, Human Ecology and Education, and the Michigan Family Independence Agency, the Michigan Department of Community Health and the Michigan Department of Agriculture to support new directions in research, problem solving and multidisciplinary outreach scholarship on children, youth and families, including creating new programs for professional development and networking, promoting and coordinating research on diversity, developing analytical frameworks and research on youth assets and resiliency and community support, and promoting new analytical frameworks and methodology for research on social capital.

## Target Audiences:

MAES programs in children, youth, families and communities are intended to assist children, youth, families, communities, government and private agencies, and other people interested in these areas.

## Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

- \* Have there been encouragement for new directions in scholarship and new applications for problem solving; administrative and financial support for multidisciplinary outreach scholarship and strategic research; forums for professional development, grantsmanship intelligence and networking of faculty members with foundations with shared interests; and partnerships formed with university programs and expertise for planning and evaluation?
- \* Has research on diversity been promoted and coordinated to address issues of migrant and seasonal laborers and their families and community capacity to meet needs of diverse children, youth and families?
- \* Have analytical frameworks and research on youth assets and resiliency and community support been developed?
- \* Have new analytical frameworks and methodology for research on social capital in domestic and international contexts been promoted?
- \* Has a commitment been secured for on-going funding and leadership for the Coalition for Children, Youth, Families and Communities?

# **Farm Management**

## **Key Program Components:**

- \* Encouraging the competitiveness of agrifood system participants in a globalized, value-added marketplace.
- \* Studying and interpreting decisions made by the World Trade Organization on non-tariff trade barriers.
- \* Better understanding the role of farm, rural development and environmental groups in agricultural research and development policy.

## **Performance Goals:**

### **Short-term Goals**

- \* Establishment of an agrifood center on the MSU campus.

(Multidisciplinary; joint with the Michigan Department of Agriculture, Michigan Farm Bureau, and the colleges of Natural Science, Social Science, Business and Engineering.)

- \* Establishment of a food grades and standards institute on the MSU campus that will promote the establishment of a network among MAES and North Central Region social, plant and animal scientists who work with and/or are concerned about the contribution of these groups to the future of agriculture and natural resources in Michigan and the region.

(Multidisciplinary; joint with the College of Social Science, Michigan commodity groups, the Michigan Department of Agriculture and Michigan Farm Bureau.)

### **Intermediate-term Goals**

- \* Through the agrifood center, investigate and offer presentations on research methodologies and techniques and their application for issues related to agribusiness management.

(Multidisciplinary; joint with the Michigan Department of Agriculture, Michigan Farm Bureau, and the colleges of Natural Science, Social Science, Business, and Engineering.)

- \* Through the food grades and standards institute, develop ways in which research data can be used in the development of complete marketing plans for specific commodities and/or products.

(Multidisciplinary; joint with the College of Social Science, Michigan commodity groups, the Michigan Department of Agriculture and Michigan Farm Bureau.)

## **Long-term Goals**

\* Through the agrifood center, develop improved analytical frameworks for assessing and implementing effective agrifood vertical coordination strategies.

(Multidisciplinary; joint with the Michigan Department of Agriculture, Michigan Farm Bureau, and the colleges of Natural Science, Social Science, Business, and Engineering.)

\* Through the agrifood center, develop improved analytical frameworks for assessing and implementing effective agrifood customer responsive strategies.

(Multidisciplinary; joint with the Michigan Department of Agriculture, Michigan Farm Bureau, and the colleges of Natural Science, Social Science, Business, and Engineering.)

\* Through the agrifood center, promote and coordinate timely research on cooperatively owned business organizations for agricultural marketing, agricultural input supply, vertical coordination through value-added processing and rural services.

(Multidisciplinary; joint with the Michigan Department of Agriculture, Michigan Farm Bureau, and the colleges of Natural Science, Social Science, Business, and Engineering.)

\* Through the agrifood center, collaborate with selected Michigan commodity organizations to: assess the extent and value of current market research databases; develop specific consumer/retailer-targeted research projects to gather and analyze demographic, psychographic and sales behavior data and provide baseline data and research models to enable commodity organizations to conduct on-going market research. *(Note: though this goal is long-term, the MAES expects annual results.)*

(Multidisciplinary; joint with the Michigan Department of Agriculture, Michigan Farm Bureau, and the colleges of Natural Science, Social Science, Business and Engineering.)

\* Through the food grades and standards institute, identify the more important and critical tactical and operational decisions facing Michigan agricultural producers and conduct an economic analysis of them.

(Multidisciplinary; joint with the College of Social Science, Michigan commodity groups, the Michigan Department of Agriculture and Michigan Farm Bureau.)

\* Through the food grades and standards institute, evaluate and develop new analysis techniques that are appropriate for tactical and operational decisions and investigate the role of usefulness of information systems to support and improve the decision-making process by Michigan agricultural firms.

(Multidisciplinary; joint with the College of Social Science, Michigan commodity groups, the Michigan Department of Agriculture and Michigan Farm Bureau.)

\* Through the food grades and standards institute, develop a comprehensive database of Michigan agricultural, rural development and environmental groups that would identify and clarify the policy, technology and organizational issues of these groups.

(Multidisciplinary; joint with the College of Social Science, Michigan commodity groups, the Michigan Department of Agriculture and Michigan Farm Bureau.)

### Internal and External Linkages:

The MAES will work with:

\* The Michigan Department of Agriculture to establish an agrifood center that will develop improved analytical frameworks for assessing and implementing effective agrifood vertical coordination strategies and customer response strategies, investigate and offer presentations on research methodologies and techniques and

applications for agribusiness management, promote and coordinate timely research on cooperatively owned business organizations, and collaborate with selected Michigan commodity organizations to assess the extent and value of current market research databases; develop specific consumer/retailer targeted research projects to gather and analyze demographic, psychographic and sales behavior data and provide baseline data and research models to enable commodity organizations to conduct on-going market research.

\* Michigan Farm Bureau to establish an agrifood center that will develop improved analytical frameworks for assessing and implementing effective agrifood vertical coordination strategies and customer response strategies, investigate and offer presentations on research methodologies and techniques and applications for agribusiness management, promote and coordinate timely research on cooperatively owned business organizations, and collaborate with selected Michigan commodity organizations to assess the extent and value of current market research databases; develop specific consumer/retailer-targeted research projects to gather and analyze demographic, psychographic and sales behavior data and provide baseline data and research models to enable commodity organizations to conduct on-going market research.

\* The College of Natural Science to establish an agrifood center that will develop improved analytical frameworks for assessing and implementing effective agrifood vertical coordination strategies and customer response strategies, investigate and offer presentations on research methodologies and techniques and applications for agribusiness management, promote and coordinate timely research on cooperatively owned business organizations, and collaborate with selected Michigan commodity organizations to assess the extent and value of current market research databases; develop specific consumer/retailer-targeted research projects to gather and analyze demographic, psychographic and sales behavior data and provide baseline data and research models to enable commodity organizations to conduct on-going market research.



\* The College of Business to establish an agrifood center that will develop improved analytical frameworks for assessing and implementing effective agrifood vertical coordination strategies and customer response strategies, investigate and offer presentations on research methodologies and techniques and applications for agribusiness management, promote and coordinate timely research on cooperatively owned business organizations, and collaborate with selected Michigan commodity organizations to assess the extent and value of current market research databases; develop specific consumer/retailer-targeted research projects to gather and analyze demographic, psychographic and sales behavior data and provide baseline data and research models to enable commodity organizations to conduct on-going market research.

\* The College of Engineering to establish an agrifood center that will develop improved analytical frameworks for assessing and implementing effective agrifood vertical coordination strategies and customer response strategies, investigate and offer presentations on research methodologies and techniques and applications for agribusiness management, promote and coordinate timely research on cooperatively owned business organizations, and collaborate with selected Michigan commodity organizations to assess the extent and value of current market research databases; develop specific consumer/retailer-targeted research projects to gather and analyze demographic, psychographic and sales behavior data and provide baseline data and research models to enable commodity organizations to conduct on-going market research.

\* The College of Social Science to establish an agrifood center that will develop improved analytical frameworks for assessing and implementing effective agrifood vertical coordination strategies and customer response strategies, investigate and offer presentations on research methodologies and techniques and applications for agribusiness management, promote and coordinate timely research on cooperatively owned business organizations, and collaborate with selected Michigan commodity organizations to assess the extent and value of current market research databases; develop specific consumer/retailer-targeted research projects to gather and analyze demographic, psychographic and sales behavior data and provide baseline data and research models to enable commodity organizations to conduct on-going market research; and a food grades and standards institute that will develop ways to use research data in the development of complete marketing plans, identify the more important and critical tactical and operational decisions facing Michigan agricultural producers, evaluate and develop new analysis techniques, and develop a comprehensive database of Michigan agricultural, rural development and environmental groups.

\* Michigan commodity organizations to establish a food grades and standards institute that will develop ways to use research data in the development of complete marketing plans, identify the more important and critical tactical and operational decisions facing Michigan agricultural producers, evaluate and develop new analysis techniques, and develop a comprehensive database of Michigan agricultural, rural development and environmental groups.

\* Michigan Farm Bureau to establish a food grades and standards institute that will develop ways to use research data in the development of complete marketing plans, identify the more important and critical tactical and operational decisions facing Michigan agricultural producers, evaluate and develop new analysis techniques, and develop a comprehensive database of Michigan agricultural, rural development and environmental groups.

\* The Michigan Department of Agriculture to establish a food grades and standards institute that will develop ways to use research data in the development of complete marketing plans, identify the more important and critical tactical and operational decisions facing Michigan agricultural producers, evaluate and develop new analysis techniques, and develop a comprehensive database of Michigan agricultural, rural development and environmental groups.

### Target Audiences:

MAES farm management programs are intended to assist families, communities, government and private agencies, agricultural producers, processors and retailers, and other people interested in these areas.

### Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific questions to be asked include:

\* Has an agrifood center been established that will develop improved analytical frameworks for assessing and implementing effective agrifood vertical coordination strategies and customer response strategies, investigate and offer presentations on research methodologies and techniques and applications for agribusiness management, promote and coordinate timely research on cooperatively owned business organizations, and collaborate with selected Michigan commodity organizations to assess the extent and value of current market research databases; develop specific consumer/retailer-targeted research projects to gather and analyze demographic, psychographic and sales behavior data and provide baseline data and research models to enable commodity organizations to conduct on-going market research?

\* Has a food grades and standards institute been established that will develop ways to use research data in the development of complete marketing plans, identify the more important and critical tactical and operational decisions facing Michigan agricultural producers, evaluate and develop new analysis techniques, and develop a comprehensive database of Michigan agricultural, rural development and environmental groups?

# Natural Resources Initiatives

## Key Program Components:

\* A Natural Resources Coalition has been established. It is a coordinating body of representatives from MSU departments, centers, institutes, colleges and programs that will set goals, priorities and action plans for research.

\* Many of the goals listed under national goal 4 are also part of the Natural Resources Coalition, but it was decided that they were most appropriately listed as part of goal 4.

## Performance Goals:

### **Short-term Goals**

\* Establish a strategic research plan to provide a framework for new natural resources programs.

(Multiinstitutional, multidisciplinary.)

### **Intermediate-term Goals**

\* Link MAES natural resources research to other key MAES initiatives.

(Multi-institutional, multidisciplinary.)

\* Study the links between tourism and production agriculture in specific areas in Michigan.

(Multi-institutional, multidisciplinary; joint with the Michigan Department of Natural Resources, Michigan Department of Environmental Quality, and the colleges of Social Science, Natural Science, Communication Arts and Sciences, and Agriculture and Natural Resources.)

### **Long-term Goals**

\* Working through the MSU Natural Resources Coalition, the MAES will develop a framework for enhancing and improving natural resources and environmental research and education; sponsor interdisciplinary teams and projects; serve as a clearinghouse for statewide information on MSU natural resources and environmental expertise and projects; provide a forum for integration of research and outreach efforts; partner with key state agencies and organizations to meet research and outreach goals; and develop a plan to address natural resources-based industry needs.

(Multi-institutional, multidisciplinary; joint with the Michigan Department of Natural Resources, Michigan Department of Environmental Quality, and the colleges of Social Science, Natural Science, and Agriculture and Natural Resources.)

\* Development of a dynamic, species-specific, spatially explicit model of forest landscapes from field studies of individual tree-environment interactions.

(Multi-institutional, multidisciplinary; joint with the Michigan Department of Natural Resources, the Michigan Department of Environmental Quality, and the colleges of Social Science, Natural Science, Communication Arts and Sciences, and Agriculture and Natural Resources.)

\* Characterization of the genetic diversity in natural and planted populations and MSU germ plasm collections of jack pine, white pine and red pine and then use of these data and population genetic models to infer and to prescribe genetic compositions for the various types of stands in Michigan.

(Multi-institutional, multidisciplinary; joint with the Michigan Department of Natural Resources, the Michigan Department of Environmental Quality, and the colleges of Social Science, Natural Science, and Agriculture and Natural Resources.)

\* Extend Michigan's hardwood forest resources by improving yield and value from hardwood logs through conversion process improvements, preserving wood and composites, and recycling of treated wood and using mixed eastern hardwoods for particleboard manufacture. This will promote forest sustainability.

(Multi-institutional, multidisciplinary; joint with the Michigan Department of Natural Resources, the Michigan Department of Environmental Quality, and the colleges of Social Science, Natural Science, and Agriculture and Natural Resources.)

\* To establish research on policy, remediation and economic issues, and to provide leadership for a program to turn brownfields into useful land.

(Multi-institutional, multidisciplinary; joint with the Michigan Department of Natural Resources, the Michigan Department of Environmental Quality, and the colleges of Social Science, Natural Science, and Agriculture and Natural Resources.)

### Internal and External Linkages:

The MAES will work with:

\* The Michigan Department of Natural Resources to study the links between tourism and production agriculture; to develop a framework for enhancing and improving natural resources research and environmental research and education; to develop a dynamic, species-specific, spatially explicit model of forest landscapes from field studies of individual tree-environment interactions; to characterize the genetic diversity in natural and planted populations and MSU germ plasm collections of jack pine, white pine and red pine, and then use of these data and population genetic models to infer and to prescribe genetic compositions for the various types of stands in Michigan; to extend Michigan's hardwood forest resources by improving yield and value from hardwood logs through conversion process improvements, preserving wood and composites and recycling of treated wood and using mixed eastern hardwoods for particleboard manufacture; and to establish research on policy, remediation and economic issues, as well as provide leadership for a program to turn brownfields into useful land.

\* The Michigan Department of Environmental Quality to study the links between tourism and production agriculture; to develop a framework for enhancing and improving natural resources research and environmental research and education; to develop a dynamic, species-specific, spatially explicit model of forest landscapes from field studies of individual tree-environment interactions; to characterize the genetic diversity in natural and planted populations and MSU germ plasm collections of jack pine, white pine and red pine, and then use of these data and population genetic models to infer and to prescribe genetic compositions for the various types of stands in Michigan; to extend Michigan's hardwood forest resources by improving yield and value from hardwood logs through conversion process improvements, preserving wood and composites and recycling of treated wood and using mixed eastern hardwoods for particleboard manufacture; and to establish research on policy, remediation and economic issues, as well as provide leadership for a program to turn brownfields into useful land.

\* The College of Social Science to study the links between tourism and production agriculture; to develop a framework for enhancing and improving natural resources research and environmental research and education; to develop a dynamic, species-specific, spatially explicit model of forest landscapes from field studies of individual tree-environment interactions; to characterize the genetic diversity in natural and planted populations and MSU germ plasm collections of jack pine, white pine and red pine, and then use of these data and population genetic models to infer and to prescribe genetic compositions for the various types of stands in Michigan; to extend Michigan's hardwood forest resources by improving yield and value from hardwood logs through conversion process improvements, preserving wood and composites and recycling of treated wood and using mixed eastern hardwoods for particleboard manufacture; and to establish research on policy, remediation and economic issues, as well as provide leadership for a program to turn brownfields into useful land.

\* The College of Natural Science to study the links between tourism and production agriculture; to develop a framework for enhancing and improving natural resources research and environmental research and education; to develop a dynamic, species-specific, spatially explicit model of forest landscapes from field studies of individual tree-environment interactions; to characterize the genetic diversity in natural and planted populations and MSU germ plasm collections of jack pine, white pine and red pine, and then use of these data and population genetic models to infer and to prescribe genetic compositions for the various types of stands in Michigan; to extend Michigan's hardwood forest resources by improving yield and value from hardwood logs through conversion process improvements, preserving wood and composites and recycling of treated wood and using mixed eastern hardwoods for particleboard manufacture; and to establish research on policy, remediation and economic issues, as well as provide leadership for a program to turn brownfields into useful land.

\* The College of Agriculture and Natural Resources to study the links between tourism and production agriculture; to develop a framework for enhancing and improving natural resources research and environmental research and education; to develop a dynamic, species-specific, spatially explicit model of forest landscapes from field studies of individual tree-environment interactions; to characterize the genetic diversity in natural and planted populations and MSU germ plasm collections of jack pine, white pine and red pine, and then use of these data and population genetic models to infer and to prescribe genetic compositions for the various types of stands in Michigan; to extend Michigan's hardwood forest resources by improving yield and value from hardwood logs through conversion process improvements, preserving wood and composites and recycling of treated wood and using mixed eastern hardwoods for particleboard manufacture; and to establish research on policy, remediation and economic issues, as well as provide leadership for a program to turn brownfields into useful land.

\* The College of Communication Arts and Sciences to a develop dynamic, species-specific, spatially explicit model of forest landscapes from field studies of individual tree-environment interactions, and to study the links between tourism and production agriculture in specific areas in Michigan.

### Target Audiences:

MAES programs in natural resources are intended to assist communities, government and private agencies, agricultural producers, processors and retailers, and other people interested in these areas.

### Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

\* Has the MAES developed a framework for enhancing and improving natural resources and environmental research and education; sponsored interdisciplinary teams and projects; served as a clearinghouse for statewide information on MSU natural resources and environmental expertise and projects; provided a forum for integration of research and outreach efforts; partnered with key state agencies and organizations to meet research and outreach goals; and developed a plan to address natural resources-based industry needs?

\* Has a dynamic, species-specific, spatially explicit model of forest landscapes been developed from field studies of individual tree-environment interactions?

\* Has the genetic diversity in natural and planted populations and MSU germ plasm collections of jack pine, white pine and red pine been characterized and then used with population genetic models to infer and to prescribe genetic compositions for the various types of stands in Michigan?

\* Have Michigan's hardwood forest resources been extended by improving yield and value from hardwood logs through conversion process improvements, preserving wood and composites, and recycling of treated wood and using mixed eastern hardwoods for particleboard manufacture?

\* Have the links between tourism and production agriculture in specific areas in Michigan been studied?

\* Has a strategic research plan to provide a framework for new natural resources programs been established?

\* Has MAES natural resources research been linked to other key MAES initiatives?

\* Has research been done on policy, remediation and economic issues and leadership provided for a program to turn brownfields into useful land?