

# 2010 University of Maine Research Plan of Work

**Status: Accepted**  
**Date Accepted: 05/26/09**

## I. Plan Overview

### 1. Brief Summary about Plan Of Work

The provisions of the Hatch Act are based on the premise that the experiment stations are in the best position to identify and address the basic and applied research needs of their respective states in the areas of agriculture, forestry, marine and rural economic development. The University of Maine System Board of Trustees concurs with this view and has declared "that the Experiment Station has central responsibilities in the state for research in agriculture, marine, forest resources, and rural economic development."

Based on its stated mission of conducting research for the people of Maine, this plan of work reflects the economic and cultural composition of Maine. Maine's economy is highly dependent on the natural resources that lie within its borders. The agriculture, forestry, and aquaculture and marine industries are all mainstays of the Maine economy. Maine's forestry-related sectors contribute an estimated \$6.5 billion to the economy, and agriculture-related industries contribute \$1.5 billion. The economic contribution of the aquaculture and marine sector easily exceeds \$1.0 billion. Maine's natural resources also attract millions of tourists each year who contribute about \$3.0 billion to the state economy.

Maine's economy faces many challenges from the state's location, size, and climate, but in some cases, these challenges are also benefits. More than 90 percent of Maine's land base is forested. Most of the 17.7 million acres of forestland is privately owned, with about half of it owned by small wood lot owners and the other half owned by large industrial forest companies. This forestland presents opportunities for Maine's tourism industry as well as the forest products industry. Maine's farms are small, averaging only 187 acres, but are increasingly diversified. Although the state is predominantly rural (ranking 39th in the nation in terms of persons per square mile), Maine is relatively close to major markets in Boston and New York. Maine's more than 3,500 miles of coastline may create transportation difficulties, but it also provides unique opportunities for aquaculture, fisheries, and tourism industries. Maine's location creates a prime testing ground for research on global climate change, as it falls along the northernmost extent of the range of some species, and the southernmost extent of the range of others.

The research described in this plan of work falls under six broad program areas: animal production and protection; economics, marketing, policy and community development; foods and nutrition; natural resources; plant production; and plant protection. MAFES research in our seventh program area, forest resources, is funded by McIntire-Stennis funds and is not covered by this plan of work. The outcomes from this research will help Maine's farmers, aquaculture producers, and food producers to increase profits, to develop new markets, and to become more competitive, help Maine to protect its valuable natural resources; help Maine communities to preserve their quality of place; and help to improve the health and wellbeing of Maine citizens.

To achieve these goals, MAFES researchers will join with other scientists and specialists from Cooperative Extension, other state and/or federal agencies, and will take part in multistate research projects that are applicable to Maine needs. MAFES administration will meet regularly with stakeholders, legislators, and others to discuss the state's needs for applied research and will direct research resources according to the input we receive.

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

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	33.0	0.0
2011	0.0	0.0	33.0	0.0
2012	0.0	0.0	33.0	0.0
2013	0.0	0.0	33.0	0.0
2014	0.0	0.0	33.0	0.0

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

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

**2. Brief Explanation**

All research projects funded by the Maine Agricultural and Forest Experiment Station (MAFES) go through three reviews. First, all pre-proposals are reviewed by the MAFES Research Council, which is comprised of senior faculty who have an established record of high productivity and high-quality research. The Research Council reviews the pre-proposals to ensure that the proposed work falls within the purview of MAFES, addresses an important need identified by stakeholders, and that the faculty member submitting the pre-proposal possesses the expertise to conduct the research.

Once approved by the Research Council, the pre-proposals are distributed to advisory committees to elicit their input on the importance of the issues addressed within the pre-proposals.

Upon receiving the input of the Research Council and the advisory committees, each faculty member develops a full research proposal for the work they wish to perform. Upon receipt of the full proposals by the Director of the Experiment Station, the proposals are sent out for external, expert peer review by scientists who are qualified to review the proposals. All reviewers are external to the University of Maine. Potential reviewers are identified through the CRIS system, faculty, and department chairs who work in related areas, and through other experiment station directors. Each proposal is sent to three to five reviewers. Upon completion of the external expert peer reviews, the proposal is returned to the researcher, who then makes changes based on the comments of the reviewers. Finally, the proposal is reviewed and approved by the Research Council before it is submitted to CSREES for final approval.

**III. Evaluation of Multis & Joint Activities****1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?**

Many of the multi-state projects and integrated research and extension programs of the Maine Agricultural and Forest Experiment Station contribute to the high-priority needs identified by stakeholders, both within Maine and throughout the nation. In fact, some stakeholder groups contribute additional funding to these programs through voluntary assessments that they pay.

NE1031—*Collaborative Potato Breeding and Variety Development Activities to Enhance Farm Sustainability in the Eastern US*—is a multistate project that develops and evaluates new potato clones for the eastern USA. Potato-breeding programs in Maine, New York, New Jersey, Ohio, North Carolina, Pennsylvania, Virginia, Wisconsin, and the ARS breeding program in Beltsville, MD, develop new potato clones and their performance is evaluated (in terms of the desired characteristics) in each of the regions of the eastern U.S.A. where potatoes are grown. This project addresses many stakeholder needs, including improved disease resistance, reduced use of pesticides, lower production costs, and culinary characteristics and qualities. All these factors ultimately contribute to the profitability of potato growers and the long-term survival of the industry.

Apple growers in the northern regions of the United States are in need of new varieties that are desired by consumers and

more vigorous rootstocks that improve yield and profitability, and are resistant to freeze damage. NC140— *Improving Economic and Environmental Sustainability in Tree-Fruit Production Through Changes in Rootstock Use*—addresses part of this critical stakeholder need by evaluating new rootstock at several locations with differing climates.

Weed control is a major problem for producers of almost all crops, whether grown organically or conventionally. Improved methods of weed control are a high-priority need identified by stakeholders across Maine. NE-1026— *Weed Management Strategies for Sustainable Cropping Systems*—determines how weeds can be suppressed with new tillage practices, rotation crops, and seed predators. Better weed control without the use of herbicides can also reduce production costs and potential environmental spillover effects, both of which are also important stakeholder needs.

For integrated extension and research activities, researchers and extension personnel at UMaine are developing an IPM program for the wild blueberry industry of Maine. The goal of this program is to improve yields, reduce weed and insect problems, reduce pesticide use and avoid the cost of inputs that do not contribute to plant health or production. This program is highly valued by wild blueberry growers and is being widely adopted. Some of the applied research is performed on stakeholders' farms.

Food safety and the development of value-added products are other high-priority needs that are addressed through integrated activities. A new food pilot plant is being used for product development and development of processing methods. Food safety is addressed through the measurement of pesticide residues of fruits and vegetables and the development and distribution of HCCAP procedures.

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

Both the Maine Agricultural and Forest Experiment Station and the University of Maine Cooperative Extension will continue their efforts to identify both underserved and underrepresented groups in the state. As the needs of these groups are identified, MAFES will develop new projects with experiment stations in other states that have the same needs; it will also develop new integrated programs with UMCE to address those needs. Hence, both multistate research projects and programs integrated with UMCE represent programs available to MAFES to serve the needs of these populations. MAFES will use these programs when they represent the best approach to address those needs.

Several of our multistate projects and integrated research and extension programs currently address needs of the under-served and under-represented populations in Maine. Historically, experiment station research has focused on food production issues of importance to growers and has ignored the needs of the consumers of the food products. Two of our multistate projects focus on the nutritional needs and habits of consumers to address high-priority needs such as obesity in the population. NC1028 examines the effectiveness of different intervention materials to encourage an increase in the consumption of fruits and vegetables in the diet of young adults. If successful, the project should reduce diet-related illnesses and obesity as this segment of the population ages. NE1023 is examining improved methods to measure fruit, vegetable and whole grains in the diet of older Americans. It will also develop and test intervention methods to improve the intake of these food products among older adults. If successful, the information should reduce diet-related disabilities, obesity and chronic diet-related disease rates in this segment of the population.

Keeping with the theme of working directly on issues the impact under-served or under-represented populations, we have developed an integrated program to determine the level of resistance to lily leaf beetle among various varieties of lilies that are popular in Maine. This will benefit home gardeners in Maine. Another integrated program has been established to work with that segment of the population who is interested in developing medicinal herb businesses in Maine. Assistance offered includes nutritional facts about various herbs, testing of herbs for nutritional content, and guidance on the business planning process. This group has not been served in the past.

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

All the research and integrated programs of MAFES are moving toward a format that emphasizes planned outcomes and impacts. Researchers will be asked to identify the outcomes and impacts that will be achieved over the life of the program and specific progress in the attainment of these outcomes and impacts will be documented and reported annually.

## **4. How will the planned programs result in improved program effectiveness and/or efficiency?**

Multistate research projects allow researchers to accomplish more as a research team than they can accomplish individually. A good example of the improved effectiveness and efficiency is the multistate potato clones project identified above. Through the multistate format, new potato clones can be tested in multiple locations on the east coast simultaneously, and the various breeding programs in the east can specialize in characteristics for which they develop clones as the other breeding programs take the lead for developing clones with other desirable characteristics.

Integrated programs also improve effectiveness by more efficiently distributing the results of the research performed by station scientists. Integrated programs also improve the identification of new research needs by facilitating the flow of

information between the stakeholders and the researchers in MAFES.

#### **IV. Stakeholder Input**

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

- Survey of traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder groups
- Survey of the general public
- Survey of traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals

##### **Brief explanation.**

Stakeholder input related to research needs is conducted on a continual basis. The manner in which the input is sought is variable, including informal discussions between Experiment Station staff/faculty and traditional and non-traditional stakeholder groups/individuals, more formal settings designed to specifically discuss stakeholder research needs, surveys of traditional groups/individuals, and surveys of the general public. The frequency in which the different methods are used is also variable. Informal discussions occur continuously. Formal meetings to elicit input occur about every two to three years, and surveys of stakeholders are usually conducted every three to five years. The surveys of stakeholders are usually done in conjunction with Cooperative Extension and the University of Maine Board of Agriculture, a legislatively mandated board to advise the university on issues related to agriculture. Surveys of the general public are usually done every five to seven years.

All identified groups/individuals are asked and encouraged to provide the input being sought. Once new groups/individuals are identified, they are placed on a listing of the groups/individuals from whom information is sought on a continual basis.

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

###### **1. Method to identify individuals and groups**

- Open Listening Sessions
- Use Internal Focus Groups
- Use External Focus Groups
- Use Advisory Committees

##### **Brief explanation.**

Existing advisory committees are good sources of information for identifying new stakeholder groups and individuals. Members of advisory groups are aware of the formation on new groups that have been formed and individuals who have assumed positions of leadership, either as individuals or leaders of the new stakeholder groups.

However, there is a need to go beyond advisory groups to insure that new groups/individuals are identified that may not be networked with existing groups for a variety of reasons. Internal focus groups, comprised of faculty, extension and other people within the University that work with external constituents, will be used to identify new groups and individuals. External focus groups, comprised of federal and state officials as well as traditional and non-traditional will also be conducted to identify new groups and individuals.

Finally, listening sessions would be held periodically around the state to elicit input and provide an opportunity for new groups and individuals to come forward and be identified as stakeholder groups and individuals to work with in the future.

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

###### **1. Methods for collecting Stakeholder Input**

- Survey of traditional Stakeholder individuals
- Meeting specifically with non-traditional individuals
- Meeting specifically with non-traditional groups
- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with invited selected individuals from the general public
- Survey of the general public
- Meeting with traditional Stakeholder individuals

**Brief explanation**

**3. A statement of how the input will be considered**

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

**Brief explanation.**

Stakeholder input is a central part of the planning process in the Maine Agricultural and Forest Experiment Station. For example, stakeholder input is used to identify emerging issues and to redirect on-going research programs to address those issues. Adjustments in short-term objectives are made regularly in these on-going research programs to address the emerging issues.

Stakeholder input is also used to make changes in the long-term direction of the research programs of MAFES, including the setting of priorities, the budget process and the hiring of new faculty. While these types of changes occur more slowly and are dependent on the availability of open positions through retirement or resignations, they represent the best option for moving into new research areas and serving the needs of new stakeholder groups.

**V. Planned Program Table of Content**

S. NO.	PROGRAM NAME
1	Natural Resources
2	Plant Production
3	Plant Protection
4	Animal Production and Protection
5	Foods and Nutrition
6	Economics, Marketing, Policy and Community Development

**V(A). Planned Program (Summary)****Program #1****1. Name of the Planned Program**

Natural Resources

**2. Brief summary about Planned Program**

The natural resources program comprises discovery research projects that focus on aspects of Maine's natural resources: water, soil, and air quality and conservation of Maine's plant and wildlife species.

MAFES water research is monitoring the health and quality of Maine's ground water, rivers, and lakes. A variety of activities in Maine pose a threat to ground water. In an effort to better understand the complex flow and transport processes within fractured bedrock aquifers, MAFES scientists are characterizing sites that are potentially contaminated with road deicing salt. Research on lakes is developing indicators of lake foodweb structure that account for inter-lake variation in response to eutrophication. For Maine's rivers, MAFES researchers are analyzing nutrient transfers from terrestrial source areas and upland watersheds to river and estuarine ecosystems in Maine and examining the risks of nonpoint pollution stress in these aquatic systems

The conservation biology focus of MAFES research includes projects on important animal species and their habitat in Maine. MAFES wildlife biologists are investigating the status, distribution, and habitat requirements of harbor and gray seal and marsh bird populations in Maine. Other research examines the effects of resource availability and quality on individual growth, breeding success, and survival of migrant and resident birds populations and patterns of adaptive diversity critical to the conservation and management of fish populations in Maine. MAFES research is also examining population genetic structure of threatened and endangered species and the forensic analysis of indigenous and introduced wildlife.

Maine's marine plant and animal life are the focus of other research. MAFES scientists are exploiting a unique organism, a photosynthetic sea slug that is the result of an interesting association between the marine mollusc *Elysia chlorotica* (sea slug) and chloroplasts of the stramenopile alga, *Vaucheria litorea*, to better understand the regulation of chloroplast function and photosynthetic efficiency. MAFES scientists are also investigating new techniques for reseeding rockweed, an important marine alga.

MAFES scientists in the natural resources program area take part in two multistate projects: NC-1142, Regulation of Photosynthetic Properties and NE-506, Wood Utilization Research on US Biofuels, Bioproducts, Hybrid Biomaterials Composites Production, and Traditional Forest Products.

MAFES conducts other research on Maine's natural resources, but the projects are funded through the McIntire-Stennis Act and do not fall under the scope of this document.

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

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

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

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

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources			5%	
102	Soil, Plant, Water, Nutrient Relationships			8%	
111	Conservation and Efficient Use of Water			2%	
112	Watershed Protection and Management			5%	
123	Management and Sustainability of Forest Resources			9%	
132	Weather and Climate			3%	
133	Pollution Prevention and Mitigation			5%	
135	Aquatic and Terrestrial Wildlife			43%	
136	Conservation of Biological Diversity			9%	
201	Plant Genome, Genetics, and Genetic Mechanisms			3%	
206	Basic Plant Biology			1%	
402	Engineering Systems and Equipment			5%	
511	New and Improved Non-Food Products and Processes			2%	
	<b>Total</b>			100%	

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

#### 1. Situation and priorities

When most people think of Maine, they think of its natural resources: its lakes, streams, and rivers, its scenic coastline, its forests, and the fish, animal, and plant species these areas support. Maine citizens value these resources highly, and judging by

Maine's \$3 billion tourism industry, people from across the country and around the world also value them. Therefore, it is a critical part of the Experiment Station's mission to provide the research necessary to conserve and preserve these resources.

Maine is a state rich in water resources. It includes more than 3,500 miles of coastline, 6,000 lakes and ponds, and 32,000 miles of rivers and streams. These waters represent a valuable part of the natural resource base in the state of Maine. They provide important ecological habitats, diverse recreational activities, valuable social amenities, unique scenic attractions, and abundant resource-based economic opportunities within the state. Unfortunately, aquatic resources in Maine and throughout the U.S. are at risk from pressures and threats associated with human population growth, climate changes, land development and sprawl, invasive exotic species, and non-point pollution. Conservation and wise management of these natural waters requires ongoing research efforts to monitor the ecological health of these systems and to detect changes and trends associated with degradation of these aquatic resources.

Maine's wild plant and animal species are another valuable part of Maine's natural resource base. Wildlife and their habitats attract anglers, hunters, and tourists to Maine, but they also serve as indicators of overall health of Maine's environment and improve quality of life for all Maine citizens. To better protect and conserve these species, the state needs more information about their genetic makeup and the relationship between these species and their environment.

The natural resources program area needs answers to basic questions about how these systems work, what effects changes in one aspect have on the system as whole. Therefore the outcomes for this program area mainly represent changes in our knowledge base. MAFES scientists are laying the foundation for further research and for other agencies to develop applications that help manage Maine's natural resources.

## 2. Scope of the Program

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

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

### 1. Assumptions made for the Program

- Funding will stay the same or increase
- Staffing levels will stay the same or increase
- Research space will be available
- Collaborations with the Maine Departments of Environmental Protection and Inland Fisheries and Wildlife, Atlantic Salmon Commission, U.S. Fish and Wildlife Service and the National Marine Fisheries Service and citizen groups such as COLA (Congress of Lake Associations) and VLMP (Volunteer Lake Monitoring Program) will continue
- Permits for fish sampling will be approved
- Parental sea slugs from Martha's Vineyard will be available each fall until culture system up and running
- Maine Department of Transportation will provide access to drilled wells •Deicing salt has leached into the groundwater at detectable concentrations •Adequate wells are available at selected MEDOT sites to characterize the ground water.

### 2. Ultimate goal(s) of this Program

To increase our understanding of and knowledge about Maine's natural resources to help the state manage these resources sustainably

## V(E). Planned Program (Inputs)

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

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	9.0	0.0
2011	0.0	0.0	9.0	0.0
2012	0.0	0.0	9.0	0.0
2013	0.0	0.0	9.0	0.0
2014	0.0	0.0	9.0	0.0

**V(F). Planned Program (Activity)**

**1. Activity for the Program**

Conduct research on Maine’s ground water and surface water resources. Conduct research on Maine native animal and plant species and their habitats. Investigate soil-landscape relationship in coastal ecosystems. Publish peer-reviewed journal articles and other publications concerning research. Present findings at professional meetings and at other venues.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>{NO DATA ENTERED}</li> </ul>	<ul style="list-style-type: none"> <li>Web sites</li> <li>Newsletters</li> </ul>

**3. Description of targeted audience**

Other scientists in plant biology, marine biology, animal biology, evolutionary biology, aquaculture, phycology, molecular biology; teachers at all levels; directors of aquariums and museums, exhibit halls, etc.; cancer biologists and pharmaceutical companies; endangered species biologists/managers; policy makers; state regulatory agencies; environmental consultants

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

**Expected Patent Applications**

**2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0**

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	16	0	0
2011	16	0	0
2012	16	0	0
2013	16	0	0
2014	16	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- # of other types of publications

**2010 :14                      2011 :14                      2012 :14                      2013 :14                      2014 :14**

- # of papers presented at professional meetings

**2010 :38                      2011 :38                      2012 :38                      2013 :38                      2014 :38**

- # of research projects completed

**2010 :3                      2011 :3                      2012 :3                      2013 :1                      2014 :1**

## V(I). State Defined Outcome

O. No	Outcome Name
1	# of new software programs created to evaluate borehole flow profile data collected using borehole geophysics
2	# of new ground-water-modeling programs created to simulate ground-water flow
3	# of people developing a better understanding of patterns of adaptive divergence in wild fish populations and the relevance of evolution in fish conservation management, annually
4	Develop industry understanding of the use of Near-IR information in the processing of woody biomass (%)
5	Industry demonstrations of the operation of NIRS on processing woody biomass (%)
6	Industry modifications of current (2007) processing lines to adopt to new NIRS-based technologies (%)
7	# of streams identified as promising or critical candidates for native salmonine conservation, based on potential perturbation from invasive species and/or riparian zone management
8	# of natural resource managers or biologists incorporating research results on conservation of native fishes into official policy and management plans
9	# of people improving their knowledge about the role of nutrients in stream health
10	Number of management agencies using empirical data and model systems to draft recommendation on fish management and conservation
11	Percentage savings for the U.S. government in the cost of estimating the number of harbor seals after a new protocol for estimating the number of harbor seals has been adopted as a standard for the Northeast.
12	Recovery actions will be implemented to conserve the endemic Clayton's copper butterfly and its habitat
13	# of local, state or federal agencies implementing management plans for Atlantic salmon
14	Increase in the distribution and abundance of migratory fish in Maine
15	Population monitoring plan will be instituted for the long-term use of the Maine Dept. of Inland Fisheries & Wildlife biologists to ensure the conservation and recovery of Clayton's copper butterfly

**Outcome #1****1. Outcome Target**

# of new software programs created to evaluate borehole flow profile data collected using borehole geophysics

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 :1                      2011 : 1                      2012 : 1                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 111 - Conservation and Efficient Use of Water
- 133 - Pollution Prevention and Mitigation

**Outcome #2****1. Outcome Target**

# of new ground-water-modeling programs created to simulate ground-water flow

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 :1                      2011 : 1                      2012 : 1                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 111 - Conservation and Efficient Use of Water
- 133 - Pollution Prevention and Mitigation

**Outcome #3****1. Outcome Target**

# of people developing a better understanding of patterns of adaptive divergence in wild fish populations and the relevance of evolution in fish conservation management, annually

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 :200                      2011 : 200                      2012 : 200                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife

**Outcome #4****1. Outcome Target**

Develop industry understanding of the use of Near-IR information in the processing of woody biomass (%)

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 :30                      2011 : 50                      2012 : 75                      2013 :75                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 402 - Engineering Systems and Equipment

**Outcome #5**

**1. Outcome Target**

Industry demonstrations of the operation of NIRS on processing woody biomass (%)

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010** 20                      **2011** : 50                      **2012** : 75                      **2013** 75                      **2014** :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 402 - Engineering Systems and Equipment

**Outcome #6**

**1. Outcome Target**

Industry modifications of current (2007) processing lines to adopt to new NIRS-based technologies (%)

**2. Outcome Type :** Change in Action Outcome Measure

**2010** 0                      **2011** : 10                      **2012** : 25                      **2013** 25                      **2014** :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 402 - Engineering Systems and Equipment

**Outcome #7**

**1. Outcome Target**

# of streams identified as promising or critical candidates for native salmonine conservation, based on potential perturbation from invasive species and/or riparian zone management

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010** 4                      **2011** : 6                      **2012** : 10                      **2013** 10                      **2014** :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife

**Outcome #8**

**1. Outcome Target**

# of natural resource managers or biologists incorporating research results on conservation of native fishes into official policy and management plans

**2. Outcome Type :** Change in Action Outcome Measure

**2010** 1                      **2011** : 3                      **2012** : 6                      **2013** 6                      **2014** :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife

**Outcome #9**

**1. Outcome Target**

# of people improving their knowledge about the role of nutrients in stream health

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 20                      2011 : 20                      2012 : 20                      2013 20                      2014 : 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife

**Outcome #10**

**1. Outcome Target**

Number of management agencies using empirical data and model systems to draft recommendation on fish management and conservation

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 3                      2011 : 3                      2012 : 3                      2013 3                      2014 : 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife

**Outcome #11**

**1. Outcome Target**

Percentage savings for the U.S. government in the cost of estimating the number of harbor seals after a new protocol for estimating the number of harbor seals has been adopted as a standard for the Northeast.

**2. Outcome Type :** Change in Condition Outcome Measure

2010 0                      2011 : 0                      2012 : 0                      2013 0                      2014 : 50

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife

**Outcome #12**

**1. Outcome Target**

Recovery actions will be implemented to conserve the endemic Clayton's copper butterfly and its habitat

**2. Outcome Type :** Change in Action Outcome Measure

2010 0                      2011 : 0                      2012 : 0                      2013 0                      2014 : 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife

**Outcome #13**

**1. Outcome Target**

# of local, state or federal agencies implementing management plans for Atlantic salmon

**2. Outcome Type :** Change in Action Outcome Measure

2010 0                      2011 : 0                      2012 : 1                      2013 : 1                      2014 : 1

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife

**Outcome #14**

**1. Outcome Target**

Increase in the distribution and abundance of migratory fish in Maine

**2. Outcome Type :** Change in Condition Outcome Measure

2010 0                      2011 : 0                      2012 : 0                      2013 : 0                      2014 : 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife

**Outcome #15**

**1. Outcome Target**

Population monitoring plan will be instituted for the long-term use of the Maine Dept. of Inland Fisheries & Wildlife biologists to ensure the conservation and recovery of Clayton's copper butterfly

**2. Outcome Type :** Change in Action Outcome Measure

2010 0                      2011 : 0                      2012 : 0                      2013 : 0                      2014 : 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife

**V(J). Planned Program (External Factors)**

**1. External Factors which may affect Outcomes**

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

**Description**

Natural disasters, weather extremes, and climate change all have the potential to affect the outcomes of MAFES natural resources research. New invasive species may affect Maine's plant and animal wildlife. Funding for university research is affected by the economy and other policy changes.

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

**1. Evaluation Studies Planned**

- During (during program)
- Before-After (before and after program)
- Comparison between locales where the program operates and sites without program intervention

**Description**

All MAFES projects are evaluated by the research council as the project ends and before the researcher is allowed to develop another project. Field tests compare results between plots/fields where inputs are changed and plots/fields where inputs are not changed.

**2. Data Collection Methods**

- Sampling
- Journals
- Observation
- Unstructured
- Tests

**Description**

Scientists collect data by sampling, conducting tests and observations, reviewing the literature.

**V(A). Planned Program (Summary)****Program #2****1. Name of the Planned Program**

Plant Production

**2. Brief summary about Planned Program**

The plant production program combines basic and applied research that aims (a) to improve the productivity and profitability of Maine's crop farms and (b) to increase the knowledge base on general plant biology and molecular biology and soil chemistry.

MAFES applied plant production research focuses on problems facing Maine's potato, wild blueberry, apple, horticulture, landscape, and small fruits and vegetable industries. Much of this research is conducted as part of multistate research projects. MAFES plant production researchers are developing and testing new potato varieties and new nutrient management systems to increase the profitability of Maine potato farms. MAFES researchers are also developing new fertility management systems to maximize profitability for Maine's wild blueberry growers. Other MAFES researchers are investigating the hardiness of apple rootstocks, ornamental plants, vegetable varieties, and turfgrass species.

MAFES discovery research focuses on native plant and tree species as well as on potato genomics and on basic soil chemistry questions. A MAFES researcher is investigating the evolutionary biology of two ecologically and economically important groups of trees, shadbushes and spruces. Other discovery researchers are focusing on comparative genomics in *Solanum* and on the factors controlling oxygen within root nodules in plants, laying the scientific groundwork that may lead to the ability to genetically engineer new nitrogen-fixing plants. Soil scientists are investigating the hydrophilic fraction of organic matter and the factors that affect the rate of organic matter decomposition.

In the plant production program area, MAFES scientists participate in the following multistate projects: NE-9, Conservation and Utilization of Plant Genetic Resources; NC-140, Improving Economic and Environmental Sustainability in Tree-Fruit Production Through Changes in Rootstock Use; NE-1031, Collaborative Potato Breeding and Variety Development Activities to Enhance Farm Sustainability in the Eastern US; NE-1017, Developing and Integrating Components for Commercial Greenhouse Production System.

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

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

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

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

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources			7%	
102	Soil, Plant, Water, Nutrient Relationships			26%	
111	Conservation and Efficient Use of Water			4%	
201	Plant Genome, Genetics, and Genetic Mechanisms			7%	
202	Plant Genetic Resources and Biodiversity			17%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			9%	
204	Plant Product Quality and Utility (Preharvest)			6%	
205	Plant Management Systems			9%	
206	Basic Plant Biology			6%	
211	Insects, Mites, and Other Arthropods Affecting Plants			3%	
212	Pathogens and Nematodes Affecting Plants			2%	
213	Weeds Affecting Plants			1%	
215	Biological Control of Pests Affecting Plants			1%	
503	Quality Maintenance in Storing and Marketing Food Products			1%	
701	Nutrient Composition of Food			1%	

	<b>Total</b>			100%	
--	--------------	--	--	------	--

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

**1. Situation and priorities**

Maine’s potato industry encompasses more than 500 businesses generating nearly \$280 million in annual sales, employing more than 2,600 people, and providing more than \$100 million in income to Maine residents). Potato production in Maine is concentrated in Aroostook County and central Penobscot County. Potato production in the Northeast is highly dependent on expensive chemical fertilizers and pesticides; growers need new management systems that produce the yields and quality needed for profitability. Potato growers in Maine and the eastern U.S. also need new potato varieties with better disease/pest resistance and better quality for fresh and processing markets. Availability of improved new varieties will increase marketing opportunities, solve production problems, and improve profitability for potato growers. Answering basic questions about the molecular basis of mechanisms that help potatoes tolerate abiotic stress will enable potato-breeding programs to develop new, stress-resistant varieties.

Wild blueberries are a unique agricultural crop in that they occur naturally in Maine and are cultivated in Maine and Maritimes Canada, with limited production in other states. Wild blueberries are grown on more than 500 farms on 64,000 acres in Maine. Most of the production is in Washington and Hancock counties, but there is also significant production in Knox, Lincoln, and Oxford counties. Maine produces the most blueberries of any state or province in North America, with an average production of more than 75 million pounds a year, which represents about 50% of the world’s wild blueberry crop. Developing new nutrient recommendations for wild blueberry will improve productivity on low-yielding fields and increase the profitability of Maine’s wild blueberry industry.

Maine’s short growing season, glacial soils, and cold climate make the state an ideal place to conduct research on the effects of these characteristics on a number of plant species. Maine apple growers, who harvest 1 million bushels of apples per year, need new, winter-hardy rootstocks that induce early bearing and are more profitable than currently grown rootstocks. Maine’s landscape and horticulture industry, part of the fastest-growing sector of American agriculture, need new ornamental plants and turfgrass varieties that can withstand Maine’s climate.

**2. Scope of the Program**

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

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

**1. Assumptions made for the Program**

•Funding will stay the same or increase •Staffing levels will stay the same or increase •Continued integration with UM Cooperative Extension to develop facts sheets, presentations/publications for growers, and updated management recommendations. •Potato industry will remain important for Maine economy •Apple production will remain stable but replanting will increase •The need for better apple rootstocks will increase •Genetic resources are available from public germplasm repositories •Genomics resources and tools are available from publicly funded Solanaceae genomics programs •Cooperation with scientists from state and federal research programs involved in genetic improvement of potato and other solanaceous species.

**2. Ultimate goal(s) of this Program**

To develop and test new varieties and management techniques and tools to increase the productivity and profitability of Maine crop producers

To improve understanding of basic biological, molecular biological, and chemical processes for economically and environmentally important Maine plants

**V(E). Planned Program (Inputs)**

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

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	5.5	0.0
2011	0.0	0.0	5.5	0.0
2012	0.0	0.0	5.5	0.0
2013	0.0	0.0	5.5	0.0
2014	0.0	0.0	5.5	0.0

**V(F). Planned Program (Activity)**

**1. Activity for the Program**

Research new ways to increase the productivity of potato, blueberry, apple, small fruit and vegetable crops. Develop and test new potato, other vegetable, and horticultural plant varieties. Conduct research on basic plant biology and molecular biology issues. Research new soil management and cover crop techniques to increase yields and improve soil quality. Research basic soil chemistry issues. Publish peer-reviewed journal articles and other publications concerning research. Present findings at professional meetings, at field days for growers, and at other venues.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>{NO DATA ENTERED}</li> </ul>	<ul style="list-style-type: none"> <li>Web sites</li> <li>Newsletters</li> </ul>

**3. Description of targeted audience**

Plant geneticists, biologists, and molecular biologists, soil scientists, extension specialists, plant breeders, Maine's horticultural industry, Maine fruit and vegetable producers, greens managers

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

**Expected Patent Applications**

**2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0**

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	12	0	0
2011	12	0	0
2012	12	0	0
2013	12	0	0
2014	12	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- # of research projects completed

**2010 :2                      2011 :2                      2012 :5                      2013 :1                      2014 :1**

- # of papers presented at professional meetings

**2010 :24                      2011 :24                      2012 :24                      2013 :24                      2014 :24**

- # of other types of publications

**2010 :9                      2011 :9                      2012 :9                      2013 :9                      2014 :9**

## V(I). State Defined Outcome

O. No	Outcome Name
1	# of improved analytical methods developed to study dissolved organic matter in soils
2	Increase in profitability for Maine apple industry from a quicker return on investment and reduction in catastrophic tree losses (\$)
3	# of commercial-scale tests of new high-yielding, high-quality, and/or pest-resistant potato clones tested in Maine
4	# of Maine seed growers adopting new high-yielding, high-quality, and/or pest-resistant clones from the Maine Potato Breeding Program or other programs represented in our commercial trial program (as indicated by entry in seed certification)
5	Decrease in percentage of lowbush blueberry leaf tissue samples with nitrogen and phosphorus deficiencies
6	Number of facilities propagating lowbush blueberry by tissue culture using information from this research
7	# of Maine lowbush blueberry growers learning about benefits of leaf sampling techniques to aid in fertility management decisions
8	Percentage of Maine lowbush blueberry growers surveyed who are changing their fertilization practices due to information provided by the fertility research program
9	# of high-quality and/or pest-resistant potato clones from the Maine Potato Breeding Program made available to other states for evaluation under diverse environmental conditions
10	# of new high-yielding, high-quality, and/or pest-resistant potato clones named and released by the Maine Potato Breeding Program
11	Percentage of Maine potato growers informed about promising new potato clones from the Maine Potato Breeding Program and other eastern programs
12	# of people improving their knowledge of the potential benefits of composting
13	Number of people surveyed using composts as a soil amendment to reduce organic waste volume and improve soil quality
14	# of Maine and New England vegetable growers learning about regionally adapted vegetable varieties
15	# of Maine vegetable growers learning about alternative crops and appropriate cultural management techniques for hoop house production
16	# of Maine vegetable growers learning about fall beds and the hybrid mulching system
17	# of Maine vegetable growers practicing crop rotation in hoop houses by growing alternative crops
18	# of Maine vegetable growers using fall made beds or hybrid mulching
19	Percentage of Maine vegetable growers that have improved management of their hoop houses
20	Reduced pesticide use and/or improved marketable yields on acres planted to new pest-resistant potato cultivars in Maine
21	Percentage of Maine potato producers improving their knowledge of the benefits of using organic amendments in their cropping systems
22	Percentage of Maine potato growers adding organic amendments to improve soil quality
23	Percentage of Maine potato growers decreasing their use of synthetic purchased fertilizer due to use of organic nutrients

**Outcome #1****1. Outcome Target**

# of improved analytical methods developed to study dissolved organic matter in soils

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 :1                      2011 : 1                      2012 : 1                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 101 - Appraisal of Soil Resources

**Outcome #2****1. Outcome Target**

Increase in profitability for Maine apple industry from a quicker return on investment and reduction in catastrophic tree losses (\$)

**2. Outcome Type :** Change in Condition Outcome Measure

2010 2500000                      2011 : 5000000                      2012 : 5000000                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

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

**Outcome #3****1. Outcome Target**

# of commercial-scale tests of new high-yielding, high-quality, and/or pest-resistant potato clones tested in Maine

**2. Outcome Type :** Change in Action Outcome Measure

2010 :10                      2011 : 10                      2012 : 10                      2013 :10                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 202 - Plant Genetic Resources and Biodiversity
- 204 - Plant Product Quality and Utility (Preharvest)
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 701 - Nutrient Composition of Food

**Outcome #4****1. Outcome Target**

# of Maine seed growers adopting new high-yielding, high-quality, and/or pest-resistant clones from the Maine Potato Breeding Program or other programs represented in our commercial trial program (as indicated by entry in seed certification)

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> 5	<b>2011</b> :7	<b>2012</b> :7	<b>2013</b> :10	<b>2014</b> :0
---------------	----------------	----------------	-----------------	----------------

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 202 - Plant Genetic Resources and Biodiversity
- 204 - Plant Product Quality and Utility (Preharvest)
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 701 - Nutrient Composition of Food

**Outcome #5****1. Outcome Target**

Decrease in percentage of lowbush blueberry leaf tissue samples with nitrogen and phosphorus deficiencies

**2. Outcome Type :** Change in Condition Outcome Measure

<b>2010</b> 50	<b>2011</b> :70	<b>2012</b> :80	<b>2013</b> 80	<b>2014</b> :0
----------------	-----------------	-----------------	----------------	----------------

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 206 - Basic Plant Biology

**Outcome #6****1. Outcome Target**

Number of facilities propagating lowbush blueberry by tissue culture using information from this research

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> 0	<b>2011</b> :0	<b>2012</b> :2	<b>2013</b> 5	<b>2014</b> :0
---------------	----------------	----------------	---------------	----------------

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 206 - Basic Plant Biology

**Outcome #7****1. Outcome Target**

# of Maine lowbush blueberry growers learning about benefits of leaf sampling techniques to aid in fertility management decisions

**2. Outcome Type :** Change in Knowledge Outcome Measure

<b>2010</b> :125	<b>2011</b> :150	<b>2012</b> :150	<b>2013</b> :150	<b>2014</b> :0
------------------	------------------	------------------	------------------	----------------

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 206 - Basic Plant Biology

**Outcome #8**

**1. Outcome Target**

Percentage of Maine lowbush blueberry growers surveyed who are changing their fertilization practices due to information provided by the fertility research program

**2. Outcome Type :** Change in Action Outcome Measure

**2010** :20                      **2011** : 40                      **2012** : 60                      **2013** : 80                      **2014** : 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 206 - Basic Plant Biology

**Outcome #9**

**1. Outcome Target**

# of high-quality and/or pest-resistant potato clones from the Maine Potato Breeding Program made available to other states for evaluation under diverse environmental conditions

**2. Outcome Type :** Change in Action Outcome Measure

**2010** :10                      **2011** : 10                      **2012** : 10                      **2013** :10                      **2014** : 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 202 - Plant Genetic Resources and Biodiversity
- 204 - Plant Product Quality and Utility (Preharvest)
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 701 - Nutrient Composition of Food

**Outcome #10**

**1. Outcome Target**

# of new high-yielding, high-quality, and/or pest-resistant potato clones named and released by the Maine Potato Breeding Program

**2. Outcome Type :** Change in Action Outcome Measure

**2010** :1                      **2011** : 1                      **2012** : 0                      **2013** : 0                      **2014** : 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 202 - Plant Genetic Resources and Biodiversity
- 204 - Plant Product Quality and Utility (Preharvest)
- 211 - Insects, Mites, and Other Arthropods Affecting Plants

- 701 - Nutrient Composition of Food

**Outcome #11**

**1. Outcome Target**

Percentage of Maine potato growers informed about promising new potato clones from the Maine Potato Breeding Program and other eastern programs

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010** :50                      **2011** :60                      **2012** :70                      **2013** 80                      **2014** :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 202 - Plant Genetic Resources and Biodiversity
- 204 - Plant Product Quality and Utility (Preharvest)
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 701 - Nutrient Composition of Food

**Outcome #12**

**1. Outcome Target**

# of people improving their knowledge of the potential benefits of composting

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010** :15                      **2011** :20                      **2012** :30                      **2013** 0                      **2014** :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 215 - Biological Control of Pests Affecting Plants

**Outcome #13**

**1. Outcome Target**

Number of people surveyed using composts as a soil amendment to reduce organic waste volume and improve soil quality

**2. Outcome Type :** Change in Action Outcome Measure

**2010** 0                      **2011** :5                      **2012** :10                      **2013** :15                      **2014** :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 215 - Biological Control of Pests Affecting Plants

**Outcome #14**

**1. Outcome Target**

# of Maine and New England vegetable growers learning about regionally adapted vegetable varieties

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010 :**1000                      **2011 :** 250                      **2012 :** 1000                      **2013 :** 250                      **2014 :** 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 205 - Plant Management Systems

**Outcome #15**

**1. Outcome Target**

# of Maine vegetable growers learning about alternative crops and appropriate cultural management techniques for hoop house production

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010 :**125                      **2011 :** 125                      **2012 :** 125                      **2013 :** 125                      **2014 :** 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 205 - Plant Management Systems

**Outcome #16**

**1. Outcome Target**

# of Maine vegetable growers learning about fall beds and the hybrid mulching system

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010 :**100                      **2011 :** 100                      **2012 :** 100                      **2013 :** 100                      **2014 :** 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 205 - Plant Management Systems

**Outcome #17**

**1. Outcome Target**

# of Maine vegetable growers practicing crop rotation in hoop houses by growing alternative crops

**2. Outcome Type :** Change in Action Outcome Measure

**2010 :**15                      **2011 :** 25                      **2012 :** 30                      **2013 :** 40                      **2014 :** 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 205 - Plant Management Systems

**Outcome #18**

**1. Outcome Target**

# of Maine vegetable growers using fall made beds or hybrid mulching

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> 8	<b>2011</b> : 10	<b>2012</b> : 15	<b>2013</b> 25	<b>2014</b> :0
---------------	------------------	------------------	----------------	----------------

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 205 - Plant Management Systems

**Outcome #19****1. Outcome Target**

Percentage of Maine vegetable growers that have improved management of their hoop houses

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> 25	<b>2011</b> : 35	<b>2012</b> : 45	<b>2013</b> 55	<b>2014</b> :0
----------------	------------------	------------------	----------------	----------------

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 205 - Plant Management Systems

**Outcome #20****1. Outcome Target**

Reduced pesticide use and/or improved marketable yields on acres planted to new pest-resistant potato cultivars in Maine

**2. Outcome Type :** Change in Condition Outcome Measure

<b>2010</b> 0	<b>2011</b> : 0	<b>2012</b> : 0	<b>2013</b> 0	<b>2014</b> :0
---------------	-----------------	-----------------	---------------	----------------

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 202 - Plant Genetic Resources and Biodiversity
- 204 - Plant Product Quality and Utility (Preharvest)
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 701 - Nutrient Composition of Food

**Outcome #21****1. Outcome Target**

Percentage of Maine potato producers improving their knowledge of the benefits of using organic amendments in their cropping systems

**2. Outcome Type :** Change in Knowledge Outcome Measure

<b>2010</b> :10	<b>2011</b> : 10	<b>2012</b> : 20	<b>2013</b> 20	<b>2014</b> :30
-----------------	------------------	------------------	----------------	-----------------

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships

- 204 - Plant Product Quality and Utility (Preharvest)
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants

**Outcome #22**

**1. Outcome Target**

Percentage of Maine potato growers adding organic amendments to improve soil quality

**2. Outcome Type :** Change in Action Outcome Measure

**2010 :** 0                      **2011 :** 2                      **2012 :** 5                      **2013 :** 7                      **2014 :** 10

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 101 - Appraisal of Soil Resources
- 204 - Plant Product Quality and Utility (Preharvest)
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants

**Outcome #23**

**1. Outcome Target**

Percentage of Maine potato growers decreasing their use of synthetic purchased fertilizer due to use of organic nutrients

**2. Outcome Type :** Change in Action Outcome Measure

**2010 :** 0                      **2011 :** 2                      **2012 :** 5                      **2013 :** 7                      **2014 :** 10

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 204 - Plant Product Quality and Utility (Preharvest)
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants

**V(J). Planned Program (External Factors)**

**1. External Factors which may affect Outcomes**

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

**Description**

All agricultural endeavors are dependent on weather, temperature, growing season length and new pest or disease species. Regulations concerning pesticide use also effects productivity/profitability. Funds for university research depend on economy and other government policies and spending priorities.

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

**1. Evaluation Studies Planned**

- Comparison between locales where the program operates and sites without program intervention
- During (during program)
- After Only (post program)

**Description**

All MAFES projects are evaluated by the research council as the project ends and before the researcher is allowed to develop another project. Individual research projects have a variety of ways to evaluate their data.

**2. Data Collection Methods**

- Observation
- Journals
- Unstructured
- Tests
- Sampling

**Description**

Scientists collect data by sampling, conducting tests and observations, reviewing the literature. In projects involving industry participants, researchers will receive input from participants on success or failure of project.

**V(A). Planned Program (Summary)**

**Program #3**

**1. Name of the Planned Program**

Plant Protection

**2. Brief summary about Planned Program**

The plant protection program combines basic and applied research that aims to understand the ecology and management of weeds, insects, plant diseases, and soil quality that reduce crop yield and/or quality. MAFES plant protection research focuses on problems facing Maine's potato, wild blueberry, and small fruits and vegetable growers.

Current projects on insect pests are investigating safer and environmentally friendly methods to control blueberry maggot fly, the most serious pest of lowbush blueberry in Maine; Colorado potato beetle, a pest that is increasingly resistant to existing insecticides; soybean aphid, which is a threat to Maine's developing soybean industry; and European fire ant, an invasive pest in communities along Maine's coast.

MAFES plant disease scientists are investigating fungal pathogens of blueberries and important diseases of potato, including *Phytophthora erythroseptica*, *P. infestans*, *Spongospora subterranea*, and *Rhizoctonia solani*.

Other MAFES research addresses the issue of weed management for Maine's potato and small fruit and vegetable growers.

In the plant protection program area, MAFES scientists participate in the following multistate projects: NRSP-4, A National Agricultural Program to Clear Pest Control Agents for Minor Uses; S-1024, Development, Evaluation and Safety of Entomopathogens for Control of Arthropod Pests; NE-1026, Weed Management Strategies for Sustainable Cropping Systems; NE-504, New England Center for Invasive Plants.

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

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

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

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

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
123	Management and Sustainability of Forest Resources			1%	
136	Conservation of Biological Diversity			4%	
201	Plant Genome, Genetics, and Genetic Mechanisms			1%	
202	Plant Genetic Resources and Biodiversity			3%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			1%	
205	Plant Management Systems			9%	
206	Basic Plant Biology			1%	
211	Insects, Mites, and Other Arthropods Affecting Plants			12%	
212	Pathogens and Nematodes Affecting Plants			16%	
213	Weeds Affecting Plants			23%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants			1%	
215	Biological Control of Pests Affecting Plants			2%	
216	Integrated Pest Management Systems			18%	
605	Natural Resource and Environmental Economics			1%	
721	Insects and Other Pests Affecting Humans			7%	

		<b>Total</b>			100%	
--	--	--------------	--	--	------	--

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

### 1. Situation and priorities

Agricultural production in the New England Region has seriously declined in recent years. Sustainable cropping systems and management practices are needed to improve agricultural viability and rural economic vitality in this region. Sustainable agriculture provides major improvements over conventional agriculture regarding soil and crop management practices; there are many limitations to sustainability, crop productivity, and farm profitability that need addressing. In the Northeast, crop losses and reduced crop quality due to pests and diseases and low overall crop productivity are critical limitations in many sustainable production systems. Conventional agricultural production uses high inputs of agricultural chemicals to address problems related to soil fertility and high levels of pests and diseases. These inputs carry with them high economic and environmental costs.

Wild blueberries are a unique agricultural crop in that they occur naturally in Maine and are cultivated in Maine and Maritimes Canada, with limited production in other states. Wild blueberries are grown on more than 500 farms on 64,000 acres in Maine. Most of the production is in Washington and Hancock counties, but there is also significant production in Knox, Lincoln, and Oxford counties. Maine produces the most blueberries of any state or province in North America, with an average production of more than 75 million pounds a year, which represents about 50% of the world's wild blueberry crop. Since Maine produces 99% of the wild blueberries in the United States, it has the strongest research and extension efforts for this crop. The results of this research are shared with growers in New Hampshire, Massachusetts, Michigan, and in Atlantic Canada and Quebec. Maine's wild blueberry growers need improved tools for managing weed and insect pests and plant diseases.

Maine's potato industry encompasses more than 500 businesses generating nearly \$280 million in annual sales, employing more than 2,600 people, and providing more than \$100 million in income to Maine residents). Potato production in Maine is concentrated in Aroostook County and central Penobscot County. Potato production in the Northeast is highly dependent on expensive chemical fertilizers and pesticides, yet productivity has not increased dramatically over the past 50 years. Maine potato growers need new strategies for controlling insect pests, such as the Colorado potato beetle, plant diseases caused by *Rhizoctonia solani*, *Phytophthora infestans*, *P. erythroseptica*, and *Spongospora subterranea*, and weeds.

Developing new methods and treatments that reduce the amount of herbicide, insecticide, or fungicide applied to Maine crops will result in both direct economic savings for growers (obtaining effective control, but applying less pesticide) and indirect economic savings for growers (minimizing detrimental effects of insecticides on pollinators and pest natural enemies). In addition, Maine's communities also benefit from this tactic because a significant reduction in the use of chemical inputs should translate into reduced risk for ground and surface water contamination, and human and wildlife exposure to pesticides.

### 2. Scope of the Program

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

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

### 1. Assumptions made for the Program

•Funding will stay the same or increase    •Staffing levels will stay the same or increase    •Weed insect and disease pressure will continue    •Growers will need to continue to adopt new practices, cooperate with researchers on projects, and learn to use new pest control materials to be able to control these pests.    •Potato industry will remain important for Maine economy.    •The slow rate at which new pesticides are developed, and increasing public pressure for environmental stewardship, will require the farming sector to increasingly rely on knowledge of the ecology of agroecosystems to produce equal or greater crop yields, of improved quality, with less reliance on pesticides for crop protection.

### 2. Ultimate goal(s) of this Program

Develop agricultural production systems that are highly productive, less susceptible to pests and diseases, and less dependent on chemical fertilizers and pesticides.

## V(E). Planned Program (Inputs)

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

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	4.9	0.0
2011	0.0	0.0	4.9	0.0
2012	0.0	0.0	4.9	0.0
2013	0.0	0.0	4.9	0.0
2014	0.0	0.0	4.9	0.0

**V(F). Planned Program (Activity)**

**1. Activity for the Program**

Research new ways to control diseases of potato and blueberry. Research new soil management techniques to control weeds. Research biological control of pests of potato, blueberry, other crops, and invasive ant species. Publish peer-reviewed journal articles and other publications concerning research. Present findings at professional meetings and at field days for growers and other venues.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>{NO DATA ENTERED}</li> </ul>	<ul style="list-style-type: none"> <li>Newsletters</li> <li>Web sites</li> </ul>

**3. Description of targeted audience**

Scientists, extension specialists, pest management professionals, potato, blueberry, and other crop producers in Maine

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

**Expected Patent Applications**

2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	10	0	0
2011	10	0	0
2012	10	0	0
2013	10	0	0
2014	10	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- # of other types of publications

2010 :8                      2011 :8                      2012 :8                      2013 :8                      2014 :8

- # of papers presented at professional meetings

2010 :30                      2011 :30                      2012 :30                      2013 :30                      2014 :30

- # of research projects completed on ways to protect valuable plant/crop species

2010 :3                      2011 :1                      2012 :4                      2013 :1                      2014 :2

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	% of potato growers familiar with effects of soil management on populations of insect
2	Average density of germinable weed seedbank found by Maine growers adopting ecologically based weed management practices (# of germinable seeds per square meter, 10 cm deep). Weed populations surviving cultivation will not reduce crop yield or quality and
3	Wild blueberry growers in Maine will be able to improve production by proper management of weed and disease pests
4	Wild blueberry growers in Maine will be able to properly identify and respond appropriately to weeds and diseases
5	Wild blueberry growers will make better management decisions on fertilizer and weed control
6	Increase in number of organic potato growers using biocontrol and mutualistic microorganisms to improve disease management, enhance crop yields, and increase soil fertility
7	Number of wild blueberry acres in Maine being treated with control measures for leaf drop diseases
8	Decrease in use of fungicides to control mummy berry disease of wild blueberry in Maine

**Outcome #1****1. Outcome Target**

% of potato growers familiar with effects of soil management on populations of insect

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 25                      2011 : 50                      2012 : 50                      2013 50                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 216 - Integrated Pest Management Systems

**Outcome #2****1. Outcome Target**

Average density of germinable weed seedbank found by Maine growers adopting ecologically based weed management practices (# of germinable seeds per square meter, 10 cm deep). Weed populations surviving cultivation will not reduce crop yield or quality and

**2. Outcome Type :** Change in Condition Outcome Measure

2010 0                      2011 : 1500                      2012 : 1500                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 213 - Weeds Affecting Plants

**Outcome #3****1. Outcome Target**

Wild blueberry growers in Maine will be able to improve production by proper management of weed and disease pests

**2. Outcome Type :** Change in Condition Outcome Measure

2010 :100                      2011 : 100                      2012 : 100                      2013 :100                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 214 - Vertebrates, Mollusks, and Other Pests Affecting Plants

**Outcome #4****1. Outcome Target**

Wild blueberry growers in Maine will be able to properly identify and respond appropriately to weeds and diseases

**2. Outcome Type :** Change in Action Outcome Measure

**2010 :**100                      **2011 :** 100                      **2012 :** 100                      **2013 :**100                      **2014 :**0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 214 - Vertebrates, Mollusks, and Other Pests Affecting Plants

**Outcome #5**

**1. Outcome Target**

Wild blueberry growers will make better management decisions on fertilizer and weed control

**2. Outcome Type :** Change in Action Outcome Measure

**2010 :**100                      **2011 :** 100                      **2012 :** 100                      **2013 :**100                      **2014 :**0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 212 - Pathogens and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 214 - Vertebrates, Mollusks, and Other Pests Affecting Plants

**Outcome #6**

**1. Outcome Target**

Increase in number of organic potato growers using biocontrol and mutualistic microorganisms to improve disease management, enhance crop yields, and increase soil fertility

**2. Outcome Type :** Change in Action Outcome Measure

**2010 :**0                      **2011 :** 0                      **2012 :** 0                      **2013 :** 0                      **2014 :**0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 205 - Plant Management Systems

**Outcome #7**

**1. Outcome Target**

Number of wild blueberry acres in Maine being treated with control measures for leaf drop diseases

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010 :**5                      **2011 :** 20                      **2012 :** 50                      **2013 :** 50                      **2014 :**50

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 202 - Plant Genetic Resources and Biodiversity

- 212 - Pathogens and Nematodes Affecting Plants
- 216 - Integrated Pest Management Systems

**Outcome #8****1. Outcome Target**

Decrease in use of fungicides to control mummy berry disease of wild blueberry in Maine

**2. Outcome Type :** Change in Action Outcome Measure

2010 0                      2011 :0                      2012 :0                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 202 - Plant Genetic Resources and Biodiversity
- 212 - Pathogens and Nematodes Affecting Plants
- 216 - Integrated Pest Management Systems

**V(J). Planned Program (External Factors)****1. External Factors which may affect Outcomes**

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

**Description**

Crop production is very dependent on weather extremes, storms, new plant diseases, weed and/or insect pest species. Funding for university research is affected by the economy and other policy changes

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

- After Only (post program)
- Comparison between locales where the program operates and sites without program intervention
- During (during program)

**Description**

All MAFES projects are evaluated by the research council as the project ends and before the researcher is allowed to develop another project. Field tests compare results between plots/fields where inputs are changed and plots/fields where inputs are not changed.

**2. Data Collection Methods**

- Journals
- On-Site
- Observation
- Tests
- Sampling
- Whole population
- Unstructured

**Description**

Scientists collect data by sampling, conducting tests and observations, reviewing the literature. Other data collection measures include survey of blueberry growers during winter blueberry school; field-level evaluations on growers' fields.

## V(A). Planned Program (Summary)

### Program #4

#### 1. Name of the Planned Program

Animal Production and Protection

#### 2. Brief summary about Planned Program

The animal production and protection program combines basic and applied research that addresses the needs of Maine's dairy and aquaculture/fisheries industries. Research for Maine's equine industry is funded through Animal Health funds and is not covered in this plan of work.

For animal agricultural production systems to be competitive in the global economy, Maine farmers must adopt new management and production techniques that will increase productivity and lower costs. Improvement of forage quality and utilization and developing methodologies for improving reproduction are among the research areas that will help Maine producers.

In addition to the traditional farm-based animal production systems, MAFES research focuses on the needs of Maine's aquaculture and commercial fisheries industries. Applied research projects are investigating ways to improve our ability to culture marine fish species as a way to broaden the state's aquaculture industry, developing new baits for the lobster industry, breeding new lines of Maine-adapted mussels and oysters, and engineering new equipment to solve real-world problems facing Maine's marine-resource-related industries. MAFES discovery research is investigating issues surrounding the health of Maine's fish and shellfish, from the effects of environmental toxicants to new vaccines for hatchery-reared trout and salmon.

In the animal production and protection program area, MAFES scientists participate in the following multistate projects: W-112, Reproductive Performance in Domestic Ruminants; NC-1038, Methods to Increase Reproductive Efficiency in Cattle; and NE-1028, Mastitis Resistance to Enhance Dairy Food Safety (Alternative Approaches to Mastitis Control in Dairy Animals).

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

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

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

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

## V(B). Program Knowledge Area(s)

### 1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals			18%	
302	Nutrient Utilization in Animals			3%	
303	Genetic Improvement of Animals			7%	
304	Animal Genome			7%	
307	Animal Production Management Systems			2%	
308	Improved Animal Products (Before Harvest)			1%	
311	Animal Diseases			32%	
312	External Parasites and Pests of Animals			7%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals			7%	
315	Animal Welfare, Well-Being and Protection			9%	
402	Engineering Systems and Equipment			7%	
	<b>Total</b>			100%	

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

#### 1. Situation and priorities

Maine dairy farmers produce about \$100 million worth of milk each year, and dairy farms employ more than 1,200 people full time and also hire many seasonal laborers. Over the past 25 years, however, there has been a steady decline in the number of dairy farms, from 775 in 1986 to fewer than 400. Maine's dairy farmers face increased production costs and depressed pricing. MAFES research is trying to increase the profitability of Maine's dairy farms by increasing the productivity of dairy cows through improving nutrition and reproduction success rates.

Maine's fisheries and aquaculture industries are comprised of marine fish and shellfish species, including Atlantic salmon, groundfish stocks, lobster, crab, clam, mussel, and oyster. The fish aquaculture industry in Maine is currently dominated by Atlantic salmon. This industry has been plagued with difficulties (disease, listing as endangered species, international competition) over the last decade and while the markets are strong, farm-gate value to the state has decreased by 25%. To

ensure its sustainability, Maine's aquaculture industry needs other potential marine species as candidates for aquaculture, new, less-expensive fish diets, and new methods for treating diseases.

Maine's shellfisheries also face challenges. The soft-shell clam has traditionally served as a fishery requiring low investment for entry by fishermen of all types. Clam harvests in eastern Maine, however, have dramatically decreased over the past 20 years, negatively affecting coastal communities already stressed by declines in their other fisheries. Research on predators of clams and the effects of toxicants is important to this industry. Maine's world-famous lobster industry is concerned with the increased threat of shell disease. Once only significant to tidal lobster pounds, cases of shell disease are increasingly prevalent in the wild and are seriously affecting not only the harvesting sector of the industry but the overall lobster stock. The culture of blue mussels and eastern oysters constitutes a significant and growing portion of the total aquacultural production in Maine. The continued growth of the Maine oyster culture industry is favored by an increased market demand for oysters coupled with declines in traditional harvesting areas in the mid-Atlantic and Gulf coast states. However, the cold temperatures typical of Maine waters result in sub-optimal growth conditions and require an extended grow-out period in order for oysters to reach market size. In contrast, while optimal conditions for the culture of blue mussels can be found throughout Maine coastal waters and there have been recent increases in the market demand for high-quality, cultured mussels, competition with imports from Canada, New Zealand and other mussel-producing countries keeps the price for domestic mussels low. Maine oyster and mussel growers need selective breeding programs for these commercially valuable shellfish species.

**2. Scope of the Program**

- Multistate Research
- In-State Research

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

**1. Assumptions made for the Program**

- Funding will stay the same or increase
- Staffing levels will stay the same or increase
- Access to dairy cows
- Participation from both oyster and mussel growers in the state
- Requires highly qualified hatchery personnel
- Requires use of the University of Maine Zebrafish Facility and trained personnel to monitor the fish stocks

**2. Ultimate goal(s) of this Program**

- To help ensure the long-term sustainability of Maine's dairy producers
- To develop the tools and techniques to support Maine's shellfisheries and aquaculture industries

**V(E). Planned Program (Inputs)**

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

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	5.4	0.0
2011	0.0	0.0	5.4	0.0
2012	0.0	0.0	5.4	0.0
2013	0.0	0.0	5.4	0.0
2014	0.0	0.0	5.4	0.0

**V(F). Planned Program (Activity)**

**1. Activity for the Program**

Research new ways to increase the reproductive success of dairy cows. Develop new stocks of mussels and oysters. Develop and test new fish diets. Develop new rearing techniques for cod and halibut. Research the efficacy of vaccines for infectious pancreatic necrosis virus. Discover the effects of toxicants on fish and shellfish. Determine the relationship between green crab and softshell clam populations. Design a GIS to track distribution of lobster shell disease. Publish peer-reviewed journal articles and other publications concerning research. Present findings at professional meetings and at other venues.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>{NO DATA ENTERED}</li> </ul>	<ul style="list-style-type: none"> <li>Newsletters</li> <li>Web sites</li> </ul>

**3. Description of targeted audience**

Scientists, extension specialists, state fisheries managers, dairy farmers, Maine’s aquaculture and shellfish industries

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

**Expected Patent Applications**

2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	10	0	0
2011	10	0	0
2012	10	0	0
2013	10	0	0
2014	10	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- # of research projects completed, annually

2010 :1                      2011 :2                      2012 :3                      2013 :1                      2014 :4

- # of papers presented at professional meetings, annually

<b>2010</b> 26	<b>2011</b> 26	<b>2012</b> 26	<b>2013</b> 26	<b>2014</b> 26
----------------	----------------	----------------	----------------	----------------

- # of other types of publications, annually

<b>2010</b> 8	<b>2011</b> 8	<b>2012</b> 8	<b>2013</b> 8	<b>2014</b> 8
---------------	---------------	---------------	---------------	---------------

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	# of DNA vaccines against infectious pancreatic necrosis virus developed and tested
2	# of thematic maps regarding incidence of lobster shell disease and other environmental factors
3	# of crab-monitoring programs undertaken by coastal communities
4	% increase in Maine's clam catch levels
5	% reduction in the use of live food inputs in diets for larval marine fish
6	Development of an effective vaccine regimen for infectious pancreatic necrosis virus will eliminate the now-mandatory destruction of diseased fish, saving Maine's aquaculture industry money
7	Increase in number of regional dairy farmers using an alternative teat dip
8	Reduction in mastitis will lead to increased income for Maine dairy farms
9	Reduction in use of disinfectant teat dips will have increased benefits for human health
10	Percentage decrease of <i>Candida albicans</i> infection in salmon aquaculture facilities in Maine

**Outcome #1****1. Outcome Target**

# of DNA vaccines against infectious pancreatic necrosis virus developed and tested

**2. Outcome Type :** Change in Knowledge Outcome Measure

<b>2010</b> 2	<b>2011</b> : 2	<b>2012</b> : 2	<b>2013</b> 0	<b>2014</b> :0
---------------	-----------------	-----------------	---------------	----------------

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 311 - Animal Diseases

**Outcome #2****1. Outcome Target**

# of thematic maps regarding incidence of lobster shell disease and other environmental factors

**2. Outcome Type :** Change in Knowledge Outcome Measure

<b>2010</b> 35	<b>2011</b> : 35	<b>2012</b> : 35	<b>2013</b> 0	<b>2014</b> :0
----------------	------------------	------------------	---------------	----------------

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 312 - External Parasites and Pests of Animals

**Outcome #3****1. Outcome Target**

# of crab-monitoring programs undertaken by coastal communities

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> :117	<b>2011</b> : 117	<b>2012</b> : 117	<b>2013</b> 0	<b>2014</b> :0
------------------	-------------------	-------------------	---------------	----------------

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 312 - External Parasites and Pests of Animals

**Outcome #4****1. Outcome Target**

% increase in Maine's clam catch levels

**2. Outcome Type :** Change in Condition Outcome Measure

<b>2010</b> 50	<b>2011</b> : 50	<b>2012</b> : 50	<b>2013</b> 0	<b>2014</b> :0
----------------	------------------	------------------	---------------	----------------

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 312 - External Parasites and Pests of Animals

**Outcome #5****1. Outcome Target**

% reduction in the use of live food inputs in diets for larval marine fish

**2. Outcome Type :** Change in Condition Outcome Measure

2010 0                      2011 : 50                      2012 : 50                      2013 0                      2014 : 0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 307 - Animal Production Management Systems
- 308 - Improved Animal Products (Before Harvest)

**Outcome #6****1. Outcome Target**

Development of an effective vaccine regimen for infectious pancreatic necrosis virus will eliminate the now-mandatory destruction of diseased fish, saving Maine's aquaculture industry money

**2. Outcome Type :** Change in Condition Outcome Measure

2010 0                      2011 : 0                      2012 : 0                      2013 0                      2014 : 0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 311 - Animal Diseases
- 315 - Animal Welfare, Well-Being and Protection

**Outcome #7****1. Outcome Target**

Increase in number of regional dairy farmers using an alternative teat dip

**2. Outcome Type :** Change in Action Outcome Measure

2010 0                      2011 : 0                      2012 : 0                      2013 0                      2014 : 0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 311 - Animal Diseases
- 315 - Animal Welfare, Well-Being and Protection

**Outcome #8****1. Outcome Target**

Reduction in mastitis will lead to increased income for Maine dairy farms

**2. Outcome Type :** Change in Condition Outcome Measure

2010 0                      2011 :0                      2012 :0                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 311 - Animal Diseases
- 315 - Animal Welfare, Well-Being and Protection

**Outcome #9**

**1. Outcome Target**

Reduction in use of disinfectant teat dips will have increased benefits for human health

**2. Outcome Type :** Change in Condition Outcome Measure

2010 0                      2011 :0                      2012 :0                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 311 - Animal Diseases
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

**Outcome #10**

**1. Outcome Target**

Percentage decrease of Candid albicans infectionin salmon aquaculture facilities in Maine

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 0                      2011 :0                      2012 :0                      2013 0                      2014 :5

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 311 - Animal Diseases

**V(J). Planned Program (External Factors)**

**1. External Factors which may affect Outcomes**

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

**Description**

Success in dairy farming is very dependent on weather extremes and aquaculture and fisheries industries are at risk from

storms, particularly hurricanes, invasive marine species. Funding for university research is affected by the economy and other policy changes.

## **V(K). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- During (during program)
- After Only (post program)

#### **Description**

All MAFES projects are evaluated by the research council as the project ends and before the researcher is allowed to develop another project. Individual research projects have a variety of ways to evaluate their data.

### **2. Data Collection Methods**

- Observation
- Tests
- Sampling
- Unstructured
- Journals

#### **Description**

Scientists collect data by sampling, conducting tests and observations, reviewing the literature. In projects involving industry participants, researchers will receive input from participants on success or failure of project.

**V(A). Planned Program (Summary)**

**Program #5**

**1. Name of the Planned Program**

Foods and Nutrition

**2. Brief summary about Planned Program**

In the MAFES Food and Nutrition program area, food scientists are developing new methods and technologies, aimed at adding value to Maine's crops and fishery resources, ensuring the quality of Maine food products, and preventing food-borne illnesses.

Nutrition research in the Foods and Nutrition program area addresses the issues of how various nutrients affect health and how to encourage people to change their diet. MAFES scientists are developing nutrition intervention materials targeting youth and the elderly to increase the amount of fruits and vegetables in their diets.

In the MAFES Food and Nutrition program area, researchers take part in the following multistate projects: NC-1028, Promoting Healthful Eating to Prevent Excessive Weight Gain in Young Adults; and NE-1023, Improving Plant Food (Fruit, Vegetable and Whole Grain) Availability and Intake in Older Adults.

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

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

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

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

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
204	Plant Product Quality and Utility (Preharvest)			11%	
308	Improved Animal Products (Before Harvest)			2%	
501	New and Improved Food Processing Technologies			12%	
502	New and Improved Food Products			9%	
503	Quality Maintenance in Storing and Marketing Food Products			3%	
701	Nutrient Composition of Food			6%	
702	Requirements and Function of Nutrients and Other Food Components			22%	
703	Nutrition Education and Behavior			19%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.			6%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			10%	
	<b>Total</b>			100%	

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

#### 1. Situation and priorities

Food production and processing is important in several key sectors in Maine: dairy, fisheries, potatoes, blueberries, and other fruits and vegetables. Maine's food producers and processors need help assessing the appeal and quality of their products, along with new techniques and technologies for preserving food quality and extending shelf life. Maine food producers and consumers are also concerned with the issue of food safety and need new rapid techniques to test for the presence of pathogens.

There is a well-established connection between good nutrition and health. The rising cost of health care is leading to a change from treating chronic diseases to preventing them through improved nutrition. Of particular concern in Maine is the nutrition of elders, because Maine's population is rapidly aging, and the young, because this is the time when people develop lifelong eating habits.

#### 2. Scope of the Program

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

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

**1. Assumptions made for the Program**

Funding will remain constant or increase. Maine’s food commodity groups will remain stable. Changes in diet and nutrition will lead to improved health.

**2. Ultimate goal(s) of this Program**

- To help Maine food producers and processors become more profitable
- To improve the safety of Maine food products
- To improve the health of Maine people through improved nutrition

**V(E). Planned Program (Inputs)**

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

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	4.0	0.0
2011	0.0	0.0	4.0	0.0
2012	0.0	0.0	4.0	0.0
2013	0.0	0.0	4.0	0.0
2014	0.0	0.0	4.0	0.0

**V(F). Planned Program (Activity)**

**1. Activity for the Program**

Conduct research experiments; publish peer-reviewed articles and other types of publications; create and test new food products; develop and test nutrition interventions; develop new methods to test for food-borne pathogens and pesticide residues; develop databases

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● {NO DATA ENTERED}</li> </ul>	<ul style="list-style-type: none"> <li>● Newsletters</li> <li>● Web sites</li> </ul>

**3. Description of targeted audience**

Scientists; extension educators; policy makers; specialty food producers; seafood processors; fruit and vegetable farmers; students; nutritionists; consumers

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

**Expected Patent Applications**

2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	9	0	0
2011	9	0	0
2012	9	0	0
2013	9	0	0
2014	9	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- # of other publications

2010 :7                      2011 :7                      2012 :7                      2013 :7                      2014 :7

- # of papers presented at meetings

2010 :20                      2011 :20                      2012 :20                      2013 :20                      2014 :20

- # of completed research projects

2010 :0                      2011 :2                      2012 :3                      2013 :3                      2014 :2

- # of crustacean mince-based products commercialized

2010 :0                      2011 :0                      2012 :1                      2013 :1                      2014 :1

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	# of new analytical methods for detecting phytochemicals in foods
2	# of Maine food processors learning about new methods to detect pesticide residues
3	Increase in consumption of fruits and vegetables by targeted young adults
4	Decrease in obesity among young adults taking part in nutrition education program
5	# of food products incorporating nutrition claims of interest to consumers
6	# of new extruded food products containing anthocyanins
7	Number of people newly aware of the health benefits of potatoes
8	Percentage increase in wild blueberry sales
9	Percentage of Maine adults who are overweight or obese
10	Increased use by Maine's blueberry industry of claims of cardiovascular health benefits of wild blueberry consumption
11	Increase in number of Maine crustacean processors producing and/or selling mince

**Outcome #1**

**1. Outcome Target**

# of new analytical methods for detecting phytochemicals in foods

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010** 5                      **2011** : 5                      **2012** : 5                      **2013** 0                      **2014** : 0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 701 - Nutrient Composition of Food
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.

**Outcome #2**

**1. Outcome Target**

# of Maine food processors learning about new methods to detect pesticide residues

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010** 3                      **2011** : 3                      **2012** : 3                      **2013** 0                      **2014** : 0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 502 - New and Improved Food Products
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

**Outcome #3**

**1. Outcome Target**

Increase in consumption of fruits and vegetables by targeted young adults

**2. Outcome Type :** Change in Condition Outcome Measure

**2010** 0                      **2011** : 0                      **2012** : 0                      **2013** 0                      **2014** : 0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 703 - Nutrition Education and Behavior

**Outcome #4**

**1. Outcome Target**

Decrease in obesity among young adults taking part in nutrition education program

**2. Outcome Type :** Change in Condition Outcome Measure

**2010** 0                      **2011** : 0                      **2012** : 0                      **2013** 0                      **2014** : 0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 703 - Nutrition Education and Behavior

**Outcome #5**

**1. Outcome Target**

# of food products incorporating nutrition claims of interest to consumers

**2. Outcome Type :** Change in Action Outcome Measure

**2010** 2                      **2011** : 6                      **2012** : 15                      **2013** :15                      **2014** :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 502 - New and Improved Food Products
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior

**Outcome #6**

**1. Outcome Target**

# of new extruded food products containing anthocyanins

**2. Outcome Type :** Change in Action Outcome Measure

**2010** 2                      **2011** : 4                      **2012** : 8                      **2013** 8                      **2014** :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 502 - New and Improved Food Products
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior

**Outcome #7**

**1. Outcome Target**

Number of people newly aware of the health benefits of potatoes

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010** 500                      **2011** : 1000                      **2012** : 5000                      **2013** 5000                      **2014** :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 502 - New and Improved Food Products
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior

**Outcome #8**

**1. Outcome Target**

Percentage increase in wild blueberry sales

**2. Outcome Type :** Change in Condition Outcome Measure

**2010** :5                      **2011** :5                      **2012** :8                      **2013** :10                      **2014** :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 502 - New and Improved Food Products
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior

**Outcome #9**

**1. Outcome Target**

Percentage of Maine adults who are overweight or obese

**2. Outcome Type :** Change in Condition Outcome Measure

**2010** :56                      **2011** :55                      **2012** :55                      **2013** :54                      **2014** :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 502 - New and Improved Food Products
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior

**Outcome #10**

**1. Outcome Target**

Increased use by Maine's blueberry industry of claims of cardiovascular health benefits of wild blueberry consumption

**2. Outcome Type :** Change in Action Outcome Measure

**2010** :0                      **2011** :0                      **2012** :0                      **2013** :0                      **2014** :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 702 - Requirements and Function of Nutrients and Other Food Components

**Outcome #11**

**1. Outcome Target**

Increase in number of Maine crustacean processors producing and/or selling mince

**2. Outcome Type :** Change in Action Outcome Measure

**2010** :0                      **2011** :0                      **2012** :0                      **2013** :1                      **2014** :1

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 308 - Improved Animal Products (Before Harvest)

- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products

## **V(J). Planned Program (External Factors)**

### **1. External Factors which may affect Outcomes**

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

#### **Description**

Natural disasters, weather extremes, and climate change all have the potential to affect the outcomes of MAFES natural resources research. New invasive species may affect Maine's plant and animal wildlife. New outbreaks of food-borne pathogens may change focus of research. Funding for university research is affected by the economy and other policy changes.

## **V(K). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- After Only (post program)
- During (during program)
- Comparisons between program participants (individuals,group,organizations) and non-participants
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.
- Before-After (before and after program)

#### **Description**

All MAFES projects are evaluated by the research council as the project ends and before the researcher is allowed to develop another project. Nutrition research compares effects on participants and nonparticipants or on participants receiving different levels of program intensity.

### **2. Data Collection Methods**

- Observation
- Sampling
- Tests
- Journals

#### **Description**

Scientists collect data by sampling, conducting tests and observations, reviewing the literature.

**V(A). Planned Program (Summary)**

**Program #6**

**1. Name of the Planned Program**

Economics, Marketing, Policy and Community Development

**2. Brief summary about Planned Program**

The economics, marketing, policy and community development program comprises research on a range of economic issues affecting Maine people and communities. Research for Maine's agricultural sector includes analysis of ways to improve profitability of Maine's equine and hay industries, analysis of technological alternatives and risk assessment for Maine farmers, evaluation of food marketing strategies, and examination of alternative food systems that better support smaller and mid-size farms. For Maine's rural communities, MAFES research is investigating the human behavior and market forces that drive land-use change and analyzing rural labor markets. Other MAFES research addresses the marketing needs of Maine's seafood producers and issues surrounding management of Maine's commercial fisheries.

In the economics, marketing, policy and community development program area, MAFES scientists participate in the following multistate projects: NC-1036, Research and Education support for the Renewal of an Agriculture of the Middle; W-2133, Benefits and Costs of Natural Resource Policies Affecting Public and Private Lands; and NE-1029, Rural Change: Markets, Governance and Quality of Life.

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

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

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

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

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
134	Outdoor Recreation			9%	
501	New and Improved Food Processing Technologies			4%	
601	Economics of Agricultural Production and Farm Management			8%	
603	Market Economics			8%	
604	Marketing and Distribution Practices			3%	
605	Natural Resource and Environmental Economics			40%	
606	International Trade and Development			6%	
607	Consumer Economics			2%	
608	Community Resource Planning and Development			18%	
703	Nutrition Education and Behavior			2%	
	<b>Total</b>			100%	

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

#### 1. Situation and priorities

Boosting profits for Maine's agricultural producers is critical. Agriculture's contribution to the state economy has declined, in real terms, by more than 25% in the ten-year period ending in 1997. Maine farmers need ways to slow this decline, including information that helps them to manage risks, to find new markets, to develop new value-added products, and even to design food systems that can successfully integrate local food production into existing food channels or create alternative channels.

As a rural state, Maine must balance the needs of communities for growth with the challenges, both economic and environmental, of sprawl and changes in land-use patterns. Community leaders need to understand the economic impacts of land-use change, such as changes in the costs of providing public services, property tax revenues, and transport costs; social impacts such as changes in community character, aesthetics, and recreation access; and ecological impacts, such as loss of habitat, fragmentation of habitat, and alteration of the hydrological regime. The relative magnitude of these impacts is often uncertain. As a result, communities and government agencies often make decisions related to land use with imperfect information.

As with most of the rest of the United States, Maine is losing many of its natural-resource-based manufacturing jobs. As

these industries decline in number of firms, payrolls, and output value, communities are searching for other enterprises to fill the economic void. A better understanding of the factors that affect rural labor markets and a focus on improving Maine’s already-strong tourism industry will help communities maintain their viability.

**2. Scope of the Program**

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

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

**1. Assumptions made for the Program**

•Funding will stay the same or increase •Staffing levels will stay the same or increase •Continued decline in natural-resource-based industries •Continued interest in tourism •Continued development pressure •Public concern over food safety and agriculture’s interface with the environment will reinforce the role of consumer and regulatory oversight  
 •Increased understanding of crop ecology and the role of biotechnology will influence the evolution of production systems and alternatives.

**2. Ultimate goal(s) of this Program**

To increase the sustainability of Maine’s rural communities by increasing local food production and the profitability of Maine farms and by providing community leaders with the information necessary to make decisions regarding development, job creation, and management of natural resources.

**V(E). Planned Program (Inputs)**

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

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	5.0	0.0
2011	0.0	0.0	5.0	0.0
2012	0.0	0.0	5.0	0.0
2013	0.0	0.0	5.0	0.0
2014	0.0	0.0	5.0	0.0

**V(F). Planned Program (Activity)**

**1. Activity for the Program**

Research new ways to increase profitability of the agricultural sector. Develop tools for modeling consequences of land-use change. Analyze rural labor markets. Create systems for managing Maine’s commercial fisheries. Publish peer-reviewed journal articles and other publications concerning research. Present findings at professional meetings, at field days for growers or producers, and at other venues.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>{NO DATA ENTERED}</li> </ul>	<ul style="list-style-type: none"> <li>Newsletters</li> <li>Web sites</li> </ul>

**3. Description of targeted audience**

Scientists, economists, state and local policymakers, extension specialists, Maine farmers and food producers, seafood processors, and commercial fishermen

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

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

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

**Expected Patent Applications**

2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	9	0	0
2011	9	0	0
2012	9	0	0
2013	9	0	0
2014	9	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- # of other types of publications

2010 8                      2011 8                      2012 8                      2013 8                      2014 8

- # of papers presented at professional meetings

2010	24	2011	24	2012	24	2013	24	2014	24
------	----	------	----	------	----	------	----	------	----

- # of research projects completed

2010	0	2011	2	2012	5	2013	4	2014	0
------	---	------	---	------	---	------	---	------	---

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	% of natural resource managers surveyed who will use spatial data on land management, land use, and land ownership in Maine
2	# of people developing a better understanding of land management, land use, and land ownership in Maine
3	State agencies will use findings to design more effective health information programs
4	Federal food safety agencies may alter the way they calculate the benefits of food safety programs and may change their food safety program priorities
5	Increased effectiveness of labeling and marketing regulations
6	Number of state agencies and regional tourism groups that will use research results in planning the types and locations of new nature-based tourism initiatives in the northern forest region

**Outcome #1****1. Outcome Target**

% of natural resource managers surveyed who will use spatial data on land management, land use, and land ownership in Maine

**2. Outcome Type :** Change in Action Outcome Measure

2010 0                      2011 : 10                      2012 : 20                      2013 20                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 605 - Natural Resource and Environmental Economics

**Outcome #2****1. Outcome Target**

# of people developing a better understanding of land management, land use, and land ownership in Maine

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 :100                      2011 : 200                      2012 : 200                      2013 200                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 605 - Natural Resource and Environmental Economics

**Outcome #3****1. Outcome Target**

State agencies will use findings to design more effective health information programs

**2. Outcome Type :** Change in Action Outcome Measure

2010 0                      2011 : 0                      2012 : 0                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 501 - New and Improved Food Processing Technologies
- 603 - Market Economics
- 607 - Consumer Economics
- 703 - Nutrition Education and Behavior

**Outcome #4****1. Outcome Target**

Federal food safety agencies may alter the way they calculate the benefits of food safety programs and may change their food safety program priorities

**2. Outcome Type :** Change in Action Outcome Measure

2010 0                      2011 :0                      2012 :0                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 501 - New and Improved Food Processing Technologies
- 603 - Market Economics
- 607 - Consumer Economics
- 703 - Nutrition Education and Behavior

**Outcome #5**

**1. Outcome Target**

Increased effectiveness of labeling and marketing regulations

**2. Outcome Type :** Change in Condition Outcome Measure

2010 0                      2011 :0                      2012 :0                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 501 - New and Improved Food Processing Technologies
- 603 - Market Economics
- 607 - Consumer Economics
- 703 - Nutrition Education and Behavior

**Outcome #6**

**1. Outcome Target**

Number of state agencies and regional tourism groups that will use research results in planning the types and locations of new nature-based tourism initiatives in the northern forest region

**2. Outcome Type :** Change in Action Outcome Measure

2010 0                      2011 :0                      2012 :0                      2013 :1                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 134 - Outdoor Recreation
- 608 - Community Resource Planning and Development

**V(J). Planned Program (External Factors)**

**1. External Factors which may affect Outcomes**

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

#### **Description**

Agriculture is dependent on weather extremes, storms, new plant diseases, weed and/or insect pest species. Funding for university research is affected by the economy and other policy changes.

### **V(K). Planned Program (Evaluation Studies and Data Collection)**

#### **1. Evaluation Studies Planned**

- Case Study
- Comparison between locales where the program operates and sites without program intervention
- Time series (multiple points before and after program)
- Comparisons between program participants (individuals,group,organizations) and non-participants
- During (during program)

#### **Description**

All MAFES projects are evaluated by the research council as the project ends and before the researcher is allowed to develop another project. Individual research projects have a variety of ways to evaluate their data.

#### **2. Data Collection Methods**

- Mail
- On-Site
- Observation
- Unstructured
- Tests
- Journals
- Whole population

#### **Description**

Scientists collect data by sampling, conducting tests and observations, reviewing the literature. Other data collection measures include surveys both by mail and through informal face-to-face discussions.