

# 2009 University of Maine Research Annual Report of Accomplishments and Results

Status: Accepted

Date Accepted: 05/28/2010

## I. Report Overview

### 1. Executive Summary

#### Merit Review Process

The external scientific peer review process fully described in our 2000-2004 Plan of Work continues to be used to evaluate all MAFES projects, regardless of funding source. A total of 21 Hatch and McIntire-Stennis projects went through the process in FY2009.

#### Stakeholder Input

MAFES took several actions to seek stakeholder input including formal meetings with advisory groups, attending monthly meetings of the Agricultural Council of Maine, using the Maine Agricultural Center to facilitate communication between MAFES and University of Maine Cooperative Extension, faculty interaction with stakeholder groups and individuals in both formal and informal settings, and field days at our research facilities.

Stakeholder groups were identified through coordinating and advisory committees. Input was collected through formal organization processes, feedback on research programs of faculty via stakeholder grant review programs, and through informal conversations with groups and individuals by MAFES leaders. Input was used internally to evaluate research, outreach, and hiring priorities for MAFES and the Maine Agricultural Center (MAC).

MAFES stakeholders emphasized the importance of research on aquaculture and the high value several agricultural groups place on the University of Maine Animal Health Laboratory..

#### Expenditure Summary

In our original Plan of Work, the Maine Agricultural & Forest Experiment Station (MAFES) estimated 33.0 SYs for 2009; the actual number of SYs was 37.9 for FY2009. For FY2009 MAFES expended \$2,031,798 (Actual Formula Funds), \$3,768,668 (Actual Matching Funds), \$2,579,246 (Actual All Other Funds), for a total of \$8,379,712.

#### Planned Programs

When creating our original Plan of Work, we grouped MAFES research into seven program areas: Forest Resources, Natural Resources, Plant Production, Plant Protection, Animal Production and Protection, Foods and Nutrition, and Economics, Marketing, Policy and Community Development. Research in the Forest Resources program area is funded by McIntire-Stennis and does not fall within scope of the Plan of Work. In response to the request for reporting on the five NIFA program areas, however, MAFES has added three additional program areas to this annual report: Sustainable Energy, Childhood Obesity, and Food Safety.

#### *Sustainable Energy*

In the newly created Sustainable Energy program area, MAFES allocated 1.8 SYs. During FY2009, MAFES expended \$93,869 (Hatch), and \$145,847 (1862 Matching), \$0 (1862 All Other) for a total of \$239,716 in this program area. In FY2009 there were three research projects in this program area, falling under three knowledge areas. These projects and researchers had previously been part of our Natural Resources program area.

MAFES research in this program area has resulted in a number of outputs for FY2009, including a patent, publications, and presentations at professional meetings, workshops, and other venues. The outcomes in this program area are elucidated in the outcome section and focus on developing methods to use Maine's abundant wood resources as a source of biofuel.

#### *Childhood Obesity*

MAFES allocated 0.8 SYs to the newly created Childhood Obesity program area. During FY2009, MAFES expended \$42,729 (Hatch), and \$130,881 (1862 Matching), \$35,229 (1862 All Other) for a total of \$208,839 in this program area. In FY2009 there were two research projects in this program area, falling under three knowledge areas. These projects and researchers had previously been part of our Foods & Nutrition program area.

MAFES research in this program area has resulted in a number of outputs for FY2009, including publications and presentations at professional meetings, workshops, and other venues. The outcomes in this program area are elucidated in the outcome section and focus on developing weight-gain-prevention measures for young adults.

#### *Food Safety*

MAFES allocated 1.2 SYs to the newly created Food Safety program area. During FY2009, MAFES expended \$60,493

(Hatch), and \$ 194,898 (1862 Matching), \$31,689 (1862 All Other) for a total of \$287,080 in this program area. In FY2009 there were two research projects in this program area, falling under four knowledge areas. These projects and researchers had previously been part of our Foods & Nutrition program area.

MAFES research in this program area has resulted in a number of outputs for FY2009, including publications and presentations at professional meetings, workshops, and other venues. The outcomes in this program area are elucidated in the outcome section and focus on developing new ways to protect food sources from food-borne pathogens and harmful chemicals.

#### *Natural Resources*

In our original plan of work, we estimated that there would be 7.2 SYs in this program area; the actual amount of SYs allocated for 2009 was 5.3. During FY2009, in this program area MAFES expended \$287,080 (Hatch), and \$516,815 (1862 Matching), \$814,088 (1862 All Other) for a total of \$1,617,983. In FY2009 there were 12 research projects in this program area, falling under 11 knowledge areas. Three projects from this program area were moved to form the new Sustainable Energy program area.

MAFES research in this program area has resulted in a number of outputs for FY2009, including completed projects, publications, and presentations at professional meetings, workshops, and other venues.

There were several outcomes in this program area during FY2009, which are elucidated in the outcome section. To highlight a few: MAFES researchers have discovered a previously unknown, but potentially important, flyway that songbirds are using as a shortcut across the Gulf of Maine; MAFES ecologists have established a very successful community-based vernal-pool-mapping program; and based on MAFES research on Clayton's copper butterfly, the Maine Department of Inland Fish & Wildlife has modified habitat management plans at two state wildlife management areas.

#### *Plant Production*

In our original plan of work, we estimated that there would be 5.0 SYs in this program area; the actual amount of SYs allocated for 2009 was 7.9. During FY2009, in this program area MAFES expended \$349,814 (Hatch), and \$605,006 (1862 Matching), \$724,840 (1862 All Other) for a total of \$1,679,660. In FY2009 there were 14 research projects in this program area, falling under 18 knowledge areas.

MAFES research in this program area has resulted in a number of outputs for FY2009, including completed projects, publications, and presentations at professional meetings, workshops, and other venues.

There were several outcomes in this program area during FY2009, which are elucidated in the outcome section. To highlight a few: MAFES research found unexpected contribution to both nitrogen and soil quality in cropping systems that used red clover; researchers changed recommendations to potato growers that reduce potash application rates by 60 kg per ha.

#### *Plant Protection*

In our original plan of work, we estimated that there would be 5.6 SYs in this program area; the actual amount of SYs expended for 2009 was 4.7. During FY2009, in this program area MAFES expended \$293,050 (Hatch), and \$634,096 (1862 Matching), \$257,592 (1862 All Other) for a total of \$1,184,738. In FY2009 there were 14 research projects in this program area, falling under 16 knowledge areas.

MAFES research in this program area has resulted in a number of outputs for FY2009, including completed projects, publications, and presentations at professional meetings, workshops, and other venues.

There were several outcomes in this program area during FY2009, which are elucidated in the outcome section. To highlight a few: based on MAFES blueberry growers have reduced by 80% to 90% the amount of organophosphates they use to control blueberry maggot fly; and MAFES scientists have introduced and trialed on local organic vegetable farms an innovative set of cultivation and flame-weeding equipment.

#### *Animal Production & Protection*

In our original plan of work, we estimated that there would be 4.7 SYs in this program area; the actual amount of SYs allocated for 2009 was 6.7. During FY2009, in this program area MAFES expended \$431,957 (Hatch), \$850,439 (1862 Matching), and \$326,126 (1862 All Other) for a total of \$1,608,522. In FY2009 there were 14 research projects in this program area, falling under 11 knowledge areas.

Research in this program area has resulted in a number of outputs for FY2009, including completed projects, publications, and presentations at professional meetings, workshops, and at other venues.

There were several outcomes in this program area during FY2007, which are elucidated in the outcome section. To highlight a few: MAFES scientists developed a full-scale prototype of the submersible mussel raft and deployed it in Upper Frenchman's Bay, Maine; and researchers released genetically improved lines of eastern oysters to industry hatcheries.

#### *Foods & Nutrition*

In our original plan of work, we estimated that there would be 4.4 SYs in this program area; the actual amount of SYs expended for 2009 was 2.1. During FY2009, in this program area MAFES expended \$120,727 (Hatch), and \$208,422 (1862

Matching), \$0 (1862 All Other) for a total of \$329,149. In FY2009 there were five research projects in this program area, falling under seven knowledge areas. Projects that had fallen under this program area have been moved to the new Childhood Obesity and Food Safety program areas.

MAFES research in this program area has resulted in a number of outputs for FY2009, including publications, and presentations at professional meetings, workshops, and other venues.

There were several outcomes in this program area during FY2009, which are elucidated in the outcome section. To highlight a few: MAFES food scientists are looking at economically feasible methods of using the green crab (an invasive, unused species) in new food products; and MAFES nutritionists have demonstrated that wild blueberries improve vasomotor tone in the young adult spontaneously hypertrophic rats and may be a potentially beneficial treatment for endothelial dysfunction.

#### *Economics, Marketing, Policy and Community Development*

In our original plan of work, we estimated that there would be 4.4 SYs in this program area; the actual amount of SYs expended for 2009 was 5.4. During FY2009, in this program area MAFES expended \$414,044 (Hatch), \$482,264 (1862 Matching) and \$389,682 (1862 All Other) for a total of \$1,285,990. In FY2009 there were 9 research projects in this program area, falling under 10 knowledge areas.

MAFES research in this program area has resulted in a number of outputs for FY2009, including completed projects, publications, and presentations at professional meetings, workshops, and at other venues.

There were several outcomes in this program area during FY2009, which are elucidated in the outcome section. To highlight a few: MAFES research helps the state run a program designed to bridge Maine dairy farmers over temporary catastrophic declines in national (and thus regional) milk prices; in a virtual, online conference, MAFES economists informed policymakers and other interested stakeholders about strategies to increase the productivity and wages of Maine workers.

#### **Total Actual Amount of professional FTEs/SYs for this State**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	33.0	0.0
Actual	0.0	0.0	37.9	0.0

## **II. Merit Review Process**

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

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

### **2. Brief Explanation**

The external scientific peer review process fully described in our 2000-2004 Plan of Work continues to be used to evaluate the scientific and societal significance of all proposed MAFES projects, regardless of funding source. A total of 21 Hatch and McIntire-Stennis projects went through the process in FY2009.

## **III. Stakeholder Input**

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

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

## **Brief explanation.**

MAFES encouraged stakeholder input by hosting (along with the college leadership) formal meetings with advisory groups including the Board of Agriculture (thriceannually), the Forest Resources Advisory Committee (twice annually), and the Coordinating Committee of the Maine Cooperative Fish and Wildlife Research Unit (annually). This year again, as a way to encourage more participation by state legislatures, one Board of Agriculture meeting was held in the state capitol building.

Other key stakeholders groups also provided input in direct or indirect ways. Three boards or committees (Wild Blueberry Commission of Maine Advisory Committee, Maine Potato Board, Cooperative Forestry Research Unit) held funding competitions where MAFES scientists submitted all or the majority of project proposals. Feedback from these committees provides information on research priorities and needs for these commodity groups.

The Director and Associate Director discussed current research programs with legislators at two college exhibitions at the State House, one in association with the agricultural industry.

The Associate Director of MAFES attended monthly meetings of the Agricultural Council of Maine as a way to maintain effective communication with the wide array of agricultural organizations in the state. These meetings provide MAFES administration with good information on issues important to Maine's agricultural community.

The Maine Agricultural Center continued to facilitate improved communication between MAFES and University of Maine Cooperative Extension and therefore between researchers and extension faculty. Extension educators are both stakeholders in research and good sources of information about the research needs of the groups they serve.

MAFES faculty, through their interaction with stakeholder groups and individuals in both formal and informal settings, also continued to encourage stakeholder participation.

At our research facilities, MAFES hosted field days held for apples, small fruits, and vegetables, potatoes, and wild blueberries and other interests of growers which allows researchers and administrators to learn more about the needs of the stakeholders in attendance.

Overall, the Station makes every effort to allow all groups and individuals to express their suggestions and concerns about station-sponsored research through the mechanisms discussed above.

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

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

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

## **Brief explanation.**

In the agricultural and forestry sectors, the major stakeholder groups are identified through coordinating and advisory committees such as the Board of Agriculture, the Forestry Research Advisory Committee, and the Coordinating Committee of the Maine Cooperative Fish and Wildlife Research Unit. MAFES provides input on potential committee members as do the current member stakeholder groups. For agriculture and forestry, MAFES maintains a list of all known stakeholders, and these groups are contacted on a regular basis. Individual stakeholders are identified in a variety of ad hoc ways including through faculty and department/school contacts as well as UMaine Cooperative Extension.

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

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

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Survey of the general public

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

**Brief explanation.**

Input is collected through formal organization processes (Board of Agriculture, Forest Resources Advisory Committee, and Maine Cooperative Fish and Wildlife Research Unit Coordinating Committee) and feedback on research programs of faculty via stakeholder grant review programs (Wild Blueberry Commission of Maine Advisory Committee, Maine Potato Board, Cooperative Forestry Research Unit). The Board of Agriculture and Forest Resources Advisory Committee reviews all MAFES project pre-proposals. The Board of Agriculture completed a survey of state agricultural organizations this year to collect information on their research and extension needs. This information will be used by the Board to advise MAFES and UMCE as the University addresses budget challenges and responds to new opportunities for research and development for Maine agriculture.

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

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

**Brief explanation.**

Input was used internally to evaluate research, outreach and hiring priorities for MAFES and the Maine Agricultural Center (MAC). As noted above, some stakeholder groups provide direct input during project approval processes. Based on the input received and the priorities set by the Board of Agriculture and Forest Research Advisory Committee, critical areas were identified for emphasis and support. Since agriculture is a dynamic industry, MAC/MAFES needs to update long-range plans, and the strategic plan of the Agricultural Council of Maine, once completed, will be a key input to that process.

Additionally, joint faculty positions are being filled and/or created in response to stakeholder needs, including positions in ornamental horticulture and small woodlot management.

**Brief Explanation of what you learned from your Stakeholders**

Stakeholders emphasized that research on aquaculture was important to Maine. The Board of Agriculture welcomed the addition of a representative of the aquaculture industry per a recent legislative change on membership.

The Board of Agriculture received an informative tour of the University of Maine Animal Health Laboratory. Board members were impressed by the importance of this laboratory and its unique expertise and equipment for many of Maine's agricultural sectors (egg industry, aquaculture, livestock, small animals), the high level of industry and public demand for this laboratory's services relative to its limited capacity, and the high demand for its unique research facilities.

The results of the Board of Agriculture survey of state agricultural organizations this year were use to identify current research and extension priorities for agricultural and horticultural groups across Maine.

IV. Expenditure Summary

<b>1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)</b>			
<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	2036239	0

<b>2. Totaled Actual dollars from Planned Programs Inputs</b>				
	<b>Extension</b>		<b>Research</b>	
	<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
<b>Actual Formula</b>	0	0	2031798	0
<b>Actual Matching</b>	0	0	3768668	0
<b>Actual All Other</b>	0	0	2579246	0
<b>Total Actual Expended</b>	0	0	8379712	0

<b>3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from</b>				
<b>Carryover</b>	0	0	221871	0

**V. Planned Program Table of Content**

<b>S. No.</b>	<b>PROGRAM NAME</b>
1	Sustainable Energy
2	Childhood Obesity
3	Food Safety
4	Natural Resources
5	Plant Production
6	Plant Protection
7	Animal Production and Protection
8	Foods and Nutrition
9	Economics, Marketing, Policy and Community Development

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

Sustainable Energy

**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			41%	
402	Engineering Systems and Equipment			43%	
511	New and Improved Non-Food Products and Processes			16%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Actual	0.0	0.0	1.8	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	93869	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	145847	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

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

MAFES scientists conduct research on the production of biofuels from wood to demonstrate that northeastern conifer species can be used as resources for the extraction of high levels of valuable compounds. They are developing techniques to determine concentrations of useful sugars such as Xylan and Glucomannan, as well as components that may be harmful to the bio-refinery process, like lignin.

**2. Brief description of the target audience**

Scientists, forest products industry, biorefineries, state policymakers, teachers

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

**1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
<b>Actual</b>	0	0	0	0

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

**Patent Applications Submitted**

Year: 2009

Plan:

Actual: 1

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>			
<b>Actual</b>	0	12	0

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

**Output Target**

**Output #1**

**Output Measure**

- Number of other publications

Year	Target	Actual
2009	{No Data Entered}	9

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

O. No.	OUTCOME NAME
1	Developing technologies enabling in-line process level decisions
2	Using advanced biotechnologies and nanotechnologies to produce wood-based biofuels

**Outcome #1****1. Outcome Measures**

Developing technologies enabling in-line process level decisions

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

A recent UMaine NSF EPSCoR and Maine Economic Improvement Fund (MEIF) funded project committed nearly \$10.4 MM to support research in forestry bioproducts in Maine. One goal of the forest bio-products project is to develop technologies enabling in-line process level decisions. A MAFES researcher is investigating the use of Near-IR (NIR) spectroscopic (NIRS) methods on woody biomass process streams to determine processing sugars content and thereby reduce the time-consuming wet chemical sugar analysis required to determine the fate of these economically viable processing streams. If successful, rapid (measurement in seconds) in-process-line NIRS sensors could replace off-line wet chemical analyses (measurement in days), a definite benefit to the industry.

**What has been done**

The researchers have developed NIR techniques to successfully determine concentrations of useful sugars such as Xylan and Glucomannan, along with components that may be harmful to the bio-refinery process, such as lignin. Knowing the concentration of these components is fundamental to in-line decision making and full use of the extracts.

**Results**

This model successfully describes concentrations of many bio-product components commonly found in wood extracts. This combination of techniques and chemometric model will be useful as the Forest Bio-product research institute further develops processing techniques in the bio-refinery.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
402	Engineering Systems and Equipment

**Outcome #2****1. Outcome Measures**

Using advanced biotechnologies and nanotechnologies to produce wood-based biofuels

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

Wood is one of Maine's most abundant natural resources, and with adequate basic and applied research that is focused on real-world problems, MAFES researchers can provide biobased solutions to issues such as the energy crisis and the need for "home-grown" fuels. This project examines new ways to use wood that will help existing industries grow and compete in the global marketplace, but that also advances the ways that we use wood; for example in the production of liquid biofuels and bioproducts.

**What has been done**

MAFES research on biofuels focuses on the production of fuels, high-value chemicals, novel bio-nanomaterials, using advanced biotechnologies and nanotechnologies. Improvement of conversion efficiencies of wood-based materials to final products and increased sustainability of our forest resources are both anticipated by implementation of this project.

**Results**

Understanding the bioconversion capabilities of wood decay fungi is important to maximizing wood utilization in industrial and biofuel applications. This project evaluates biological methods to determine which are most effective in preserving the crystalline cellulose for composite production, as well as which are most effective in breaking it down into glucose monomers for biofuel or chemical production. Furthermore, although the potential for ethanol production from biofuels in New England is large, the logistics of ethanol transport need to be overcome. University of Maine researchers are uncovering some solutions to these logistical problems. Their site assessment to date appears to favor refinery blending rather than remote mixing.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
511	New and Improved Non-Food Products and Processes

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

**External factors which affected outcomes**

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

**Brief Explanation**

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

1. Evaluation Studies Planned

**Evaluation Results**

{No Data Entered}

**Key Items of Evaluation**

{No Data Entered}

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

Childhood Obesity

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

## 1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
502	New and Improved Food Products			10%	
702	Requirements and Function of Nutrients and Other Food Components			30%	
703	Nutrition Education and Behavior			60%	
	<b>Total</b>			100%	

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

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

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Actual	0.0	0.0	0.8	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	42729	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	130881	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	35229	0

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

## 1. Brief description of the Activity

Nutrition researchers investigated ways to increase consumption of fruits, vegetables, and whole grains and completed analysis of a preclinical study on the effects of wild blueberry and wild blueberry juice consumption on appetite and blood chemistry in adults who had normal Body Mass Index or who were overweight. They published peer-reviewed articles and other types of publications and presented their findings at scientific meetings and other venues.

## 2. Brief description of the target audience

Scientists; extension educators; policy makers; students; nutritionists; dieticians; teachers; consumers.

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

**1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
<b>Actual</b>	0	0	0	0

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

**Patent Applications Submitted**

Year: 2009

Plan:

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>			
<b>Actual</b>	0	2	0

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

**Output Target**

**Output #1**

**Output Measure**

- Number of other publications

Year	Target	Actual
2009	{No Data Entered}	15

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Promoting healthful eating to prevent excessive weight gain in young adults

**Outcome #1****1. Outcome Measures**

Promoting healthful eating to prevent excessive weight gain in young adults

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

Recent data from the US Centers for Disease Control and Prevention show continued escalation of the prevalence and severity of obesity in all age, gender and socioeconomic segments of the population, costing the US an estimated \$75 billion annually. Obesity has increased dramatically since 1991, and now approximately 64% of American adults are overweight or obese. Recent epidemiological studies have documented that young adulthood is a critical time in which adverse changes in body weight are likely to occur, and that men and women aged 18-25 are a subset of young adults at particularly high risk for weight gain. Being mildly or moderately overweight at age 20-22 years is linked with substantial incidence of obesity by age 35-37 years.

**What has been done**

During year the past year, MAFES nutritionists have conducted analyses at Penobscot Job Corps related to programs, policies, and environmental strategies, working to develop plans for an intervention aimed at preventing excessive weight gain in these students, using a non-diet approach. These students are considered to be at-risk, at-promise young adults who are in a job training program administered by the US Department of Labor.

**Results**

Partnering with community members, the Penobscot Job Corps, for obesity prevention is resulting in environmental changes and a system of support to promote behavior change. The result will be a sustainable program for healthful lifestyles, reduced risk of chronic disease and improved quality of life for 18-24 year old young adults.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
703	Nutrition Education and Behavior

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

**External factors which affected outcomes**

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

**Brief Explanation**

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

1. Evaluation Studies Planned

**Evaluation Results**

{No Data Entered}

**Key Items of Evaluation**

{No Data Entered}

**V(A). Planned Program (Summary)****Program # 3****1. Name of the Planned Program**

Food Safety

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

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
502	New and Improved Food Products			3%	
701	Nutrient Composition of Food			17%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			17%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			63%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Actual	0.0	0.0	1.2	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	60493	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	194898	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	31689	0

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

MAFES scientists conducted research experiments on new food processing technologies and improved methods for detecting food-borne pathogens. They published peer-reviewed articles and other types of publications and presented their findings at scientific meetings and other venues.

**2. Brief description of the target audience**

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

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

**1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
<b>Actual</b>	0	0	0	0

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

**Patent Applications Submitted**

Year: 2009

Plan:

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>			
<b>Actual</b>	0	3	0

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

**Output Target**

**Output #1**

**Output Measure**

- Number of other publications

Year	Target	Actual
2009	{No Data Entered}	11

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

O. No.	OUTCOME NAME
1	Enhancing the survival rate of Maine lobsters stored in pounds
2	Helping Maine's fledgling elderberry industry
3	Methods to minimize patulin contamination on organic apples

**Outcome #1****1. Outcome Measures**

Enhancing the survival rate of Maine lobsters stored in pounds

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

Consumers and producers both care a great deal about the safety and health benefits of food products. There is a need for more efficient, more sensitive and less expensive methods for the analysis of both beneficial and toxic chemicals in our food and water.

**What has been done**

In a cooperation with a small Maine company and the Maine Aquatic Animal Health Laboratory, MAFES food scientists helped to establish a rapid and inexpensive analytical protocol to test the effectiveness of Florfenicol as an antibiotic in Maine lobster pounds.

**Results**

The lobster fishery is vitally important to Maine's economy, contributing some \$280M per year. Our collaborative work with the Maine Aquatic Animal Health Laboratory and with Beacon Analytical Systems has resulted in the production of a commercially available kit to test lobster hemolymph for residual Florfenicol. In addition to supporting a small company, this research will boost help boost the survival rate of lobsters stored in pounds, enhancing profit margins for lobster fishermen, wholesalers and retailers.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
701	Nutrient Composition of Food
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

**Outcome #2****1. Outcome Measures**

Helping Maine's fledgling elderberry industry

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Consumers and producers both care a great deal about the safety and health benefits of food products. There is a need for more efficient, more sensitive and less expensive methods for the analysis of both beneficial and toxic chemicals in our food and water.

**What has been done**

MAFES food scientists are working closely with two elderberry grower/processors to help establish the best varieties and the processing methods to retain the highest levels of anthocyanins and phenolic compounds in a number of elderberry products. This analytical work includes assessing and quantifying individual anthocyanins and phenolic acids using sophisticated instrumentation.

**Results**

These collaborative projects with Maine elderberry entrepreneurs have resulted in significant improvement of antioxidant levels in elderberry food products, enabling the tiny company and fledgling Maine elderberry industry to grow significantly over the past year.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
701	Nutrient Composition of Food
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

**Outcome #3**

**1. Outcome Measures**

Methods to minimize patulin contamination on organic apples

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
------	---------------------	--------

2009 {No Data Entered} 0

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

Patulin is a mycotoxin produced by mold and often found in rotting apples. Although it is not particularly potent, the World Health Organization has set recommendations for levels in apple juice/cider. While there is increasing demand for organic food products, consumers are concerned about food safety. Organic standards limit certain tools that are available to other food producers.

**What has been done**

In joint projects with the University of Maine Laboratory for Surface Science and Technology, MAFES food scientists continued work to develop a rapid sensor for the mycotoxin patulin in apple products. The goal of this research will be to make existing procedures more sensitive, reliable and inexpensive. The researchers are working with University of Maine Cooperative Extension researchers towards the development and implementation of processing techniques to minimize patulin contamination of the food supply.

**Results**

The food scientists recently completed work using vinegar as a natural biological control to reduce patulin concentrations in apple cider. This new method gives organic growers and cider producers a new tool to control the levels of this mycotoxin in their products, resulting in a safer product and expanding options for value-added organic apple products.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
701	Nutrient Composition of Food
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

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

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

## 1. Evaluation Studies Planned

**Evaluation Results**

{No Data Entered}

**Key Items of Evaluation**

{No Data Entered}

**V(A). Planned Program (Summary)****Program # 4****1. Name of the Planned Program**

Natural Resources

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

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
102	Soil, Plant, Water, Nutrient Relationships			6%	
111	Conservation and Efficient Use of Water			11%	
112	Watershed Protection and Management			7%	
123	Management and Sustainability of Forest Resources			1%	
133	Pollution Prevention and Mitigation			4%	
134	Outdoor Recreation			4%	
135	Aquatic and Terrestrial Wildlife			54%	
136	Conservation of Biological Diversity			2%	
201	Plant Genome, Genetics, and Genetic Mechanisms			5%	
206	Basic Plant Biology			2%	
608	Community Resource Planning and Development			4%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	0.0	0.0	6.3	0.0
Actual	0.0	0.0	5.3	0.0

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

<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	225115	0
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	516815	0
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	814088	0

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

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. Brief description of the target 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(E). Planned Program (Outputs)****1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Year: 2009

Plan: 0

Actual: 0

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

2009	Extension	Research	Total
Plan	0	16	
Actual	0	11	0

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

- # of other types of publications

Year	Target	Actual
2009	14	22

**Output #2**

**Output Measure**

- # of papers presented at professional meetings  
Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- # of research projects completed

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	4	3

## V(G). State Defined Outcomes

### V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of complete chloroplast gene sequences submitted to GenBank for public use for <i>Vaucheria litorea</i>
2	# of people increasing their knowledge about the interactions between seals and Atlantic salmon, annually
3	# of people increasing their knowledge about the contribution of watershed nutrient exports to non-point pollution and nutrient cycling in Maine rivers and coastal waters
4	# of lakes from which data are used in a database to quantify statistical relationship and to develop empirical models
5	# of new software programs created to evaluate borehole flow profile data collected using borehole geophysics
6	# of new ground-water-modeling programs created to simulate ground-water flow
7	# of people improving their understanding of habitat requirements for marsh bird species of management concern in Maine, annually
8	# 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
9	# of state and/or federal agencies using information on marsh bird species occurrence and habitat requirements in making assessments and recommendations on development proposals near wetlands
10	# of state agencies using information on marsh bird species occurrence and habitat requirements to develop recovery strategies for rare marsh bird species
11	# of new recommendations for maintaining water quality in Maine rivers and minimizing adverse impacts of non-point pollution
12	# of state agencies using information on watershed nutrient exports for developing new recommendations for maintaining water quality in Maine rivers and minimizing the impacts of non-point pollution
13	Number of public school children and other visitors to the area using a checklist for birds for the Dwight B. Demeritt Forest in Orono/Old Town, Maine, and a checklist for birds for the Penobscot Experimental Forest in Bradley/Eddington, Maine
14	Number of Internet-accessible databases containing what may be the largest and most complete set of ecological and physiological data on a wide variety of songbirds from North America
15	# of lake associations, such as Congress of Lake Associations, promoting maintenance of healthy lake foodwebs
16	# of management agencies using measurement of lake foodweb structure in their lake assessment and education programs
17	# of management agencies using information on seal behavior to create management plans
18	# of rare marsh bird species affected by changes in harvest regulations

19	% decrease in nutrient enrichment of Maine rivers and coastal waters
20	Develop industry understanding of the use of Near-IR information in the processing of woody biomass (%)
21	Industry demonstrations of the operation of NIRS on processing woody biomass (%)
22	Industry modifications of current (2007) processing lines to adopt to new NIRS-based technologies (%)
23	# of streams identified as promising or critical candidates for native salmonine conservation, based on potential perturbation from invasive species and/or riparian zone management
24	# of natural resource managers or biologists incorporating research results on conservation of native fishes into official policy and management plans
25	# of people improving their knowledge of the impacts of perturbations from invasive species and/or riparian zone management on the ecology of native Maine salmonids
26	# of people improving their knowledge about the role of nutrients in stream health
27	The distribution and abundance of migratory fish in Maine will increase
28	Number of management agencies using empirical data and model systems to draft recommendation on fish management and conservation
29	Improved understanding of evolutionary ecology of fishes: adaptive variation and conservation
30	Number of agencies modifying management plans to conserve habitat for Claytons copper butterfly
31	Increasing community involvement in vernal pool mapping
32	Checklist of Maine's Forest Birds
33	Solving Groundwater Quality and Quantity Issues in the Northeast with Citizen Science
34	Discovery of potentially important flyway for songbirds crossing the Gulf of Maine

## **Outcome #1**

### **1. Outcome Measures**

# of complete chloroplast gene sequences submitted to GenBank for public use for *Vaucheria litorea*

### **2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	75	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

New gene information was deposited in GenBank and the entire genomic sequence of an algal (*Vaucheria litorea*) chloroplast genome and a sea slug (*Elysia chlorotica*) mitochondrial genome were published.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

**Outcome #2**

**1. Outcome Measures**

# of people increasing their knowledge about the interactions between seals and Atlantic salmon, annually

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	100	85

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
135	Aquatic and Terrestrial Wildlife

**Outcome #3**

**1. Outcome Measures**

# of people increasing their knowledge about the contribution of watershed nutrient exports to non-point pollution and nutrient cycling in Maine rivers and coastal waters

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	30	30

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
112	Watershed Protection and Management

**Outcome #4**

**1. Outcome Measures**

# of lakes from which data are used in a database to quantify statistical relationship and to develop empirical models

Not Reporting on this Outcome Measure

**Outcome #5****1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	1

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

Saline groundwater has impacted domestic drinking water wells in the Jonesboro (Maine) area for over a decade. Deicing salts historically stockpiled north of Route 1 (Harrington Road) near the Jonesboro town center are likely the source of this saline groundwater, but its spread through the overburden and the fractured bedrock to domestic wells is poorly understood.

**What has been done**

MAFES scientists met with Maine Dept. of Transportation personnel involved in remedial action at this site to identify abandoned wells within a zone of saline groundwater that we could access. The researchers have prepared plots of data and a computer program, based on python language, has been created to simulate flow within a single borehole.

**Results**

This software will be of use to environmental professionals who collect data with the heat pulse and other flow meters to characterize the subsurface. Information provided through the use of this software will provide important information on the hydraulic properties of fracture-controlled aquifers.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
133	Pollution Prevention and Mitigation

**Outcome #6****1. Outcome Measures**

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

Not Reporting on this Outcome Measure

## **Outcome #7**

### **1. Outcome Measures**

# of people improving their understanding of habitat requirements for marsh bird species of management concern in Maine, annually

Not Reporting on this Outcome Measure

## **Outcome #8**

### **1. Outcome Measures**

# 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

Not Reporting on this Outcome Measure

## **Outcome #9**

### **1. Outcome Measures**

# of state and/or federal agencies using information on marsh bird species occurrence and habitat requirements in making assessments and recommendations on development proposals near wetlands

Not Reporting on this Outcome Measure

## **Outcome #10**

### **1. Outcome Measures**

# of state agencies using information on marsh bird species occurrence and habitat requirements to develop recovery strategies for rare marsh bird species

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	1	1

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

A number of marsh bird species are of management concern in Maine and the northeastern U.S. because of limited information on their population status and ecology.

#### **What has been done**

MAFES scientists conducted a study to determine whether populations of these species are decreasing in Maine

and to learn more about their habitat requirements. They analyzed data on habitat characteristics for the American Bitterns, Virginia Rails, Soras, Pied-billed Grebes, and Least Bitterns using data from 215 wetlands, focusing in the last year on estimating minimum threshold values for specific habitat types to explain marsh bird occurrence in wetlands.

**Results**

The analyses provided new knowledge on relative long-term and unknown population trends for American Bitterns, Virginia Rails, Least Bitterns, Soras, Pied-billed Grebes in Maine. Virginia Rails and Soras have increased in abundance and wetland occupancy; Least Bitterns have declined; and American Bitterns and Pied-billed Grebes have been relatively stable. The relatively steep decline in wetland occupancy for the Least Bitterns measured in this study was a major factor in legal listing of this species as endangered by the Maine Department of Inland Fisheries and Wildlife and the Maine Legislature.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
135	Aquatic and Terrestrial Wildlife

**Outcome #11**

**1. Outcome Measures**

# of new recommendations for maintaining water quality in Maine rivers and minimizing adverse impacts of non-point pollution

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
112	Watershed Protection and Management

## **Outcome #12**

### **1. Outcome Measures**

# of state agencies using information on watershed nutrient exports for developing new recommendations for maintaining water quality in Maine rivers and minimizing the impacts of non-point pollution

Not Reporting on this Outcome Measure

## **Outcome #13**

### **1. Outcome Measures**

Number of public school children and other visitors to the area using a checklist for birds for the Dwight B. Demeritt Forest in Orono/Old Town, Maine, and a checklist for birds for the Penobscot Experimental Forest in Bradley/Eddington, Maine

Not Reporting on this Outcome Measure

## **Outcome #14**

### **1. Outcome Measures**

Number of Internet-accessible databases containing what may be the largest and most complete set of ecological and physiological data on a wide variety of songbirds from North America

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	0	0

### **3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
135	Aquatic and Terrestrial Wildlife

### **Outcome #15**

#### **1. Outcome Measures**

# of lake associations, such as Congress of Lake Associations, promoting maintenance of healthy lake foodwebs

Not Reporting on this Outcome Measure

### **Outcome #16**

#### **1. Outcome Measures**

# of management agencies using measurement of lake foodweb structure in their lake assessment and education programs

Not Reporting on this Outcome Measure

### **Outcome #17**

#### **1. Outcome Measures**

# of management agencies using information on seal behavior to create management plans

Not Reporting on this Outcome Measure

### **Outcome #18**

#### **1. Outcome Measures**

# of rare marsh bird species affected by changes in harvest regulations

#### **2. Associated Institution Types**

- 1862 Research

#### **3a. Outcome Type:**

Change in Condition Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	3	1

#### **3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

This study provided critically needed information on population trends for the American Bittern, Virginia Rail, Least Bittern, Sora, and Pied-billed Grebe in Maine. Virginia Rails and Soras have increased in abundance based on

rates of wetland occupancy; the Least Bittern populations has declined; and American Bitterns and Pied-billed Grebes have been relatively stable. Results from this study led to the state-listing of the Least Bittern as endangered in Maine. Results from the present study will be used by collaborators in the Maine Department of Inland Fisheries and Wildlife to design future marsh bird surveys and to provide consultation to other agencies in permit review processes.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

##### Outcome #19

###### 1. Outcome Measures

% decrease in nutrient enrichment of Maine rivers and coastal waters

Not Reporting on this Outcome Measure

##### Outcome #20

###### 1. Outcome Measures

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

Not Reporting on this Outcome Measure

##### Outcome #21

###### 1. Outcome Measures

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

Not Reporting on this Outcome Measure

##### Outcome #22

###### 1. Outcome Measures

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

Not Reporting on this Outcome Measure

##### Outcome #23

###### 1. Outcome Measures

# 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. Associated Institution Types

- 1862 Research

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	2	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Native fishes, and salmonines in particular, are threatened throughout much of their respective ranges. In the U.S., Maine is the largest stronghold for wild brook trout and also contains the only remaining wild Atlantic salmon populations. The persistence of these, and other, fishes is threatened by many factors, including habitat alteration and competition from exotic species.

#### What has been done

A MAFES project is providing fishery managers with the information to improve native fisheries while balancing conflicting objectives of many groups of resource users. The researchers have added large woody debris to stream channels to simulate the natural influx of dead trees from mature forests. They have treated 10 miles of headwater streams with wood, affecting 100,000 watershed acres.

#### Results

The before-and-after monitoring in treatment and control sites allows the researchers to quantify results and inform future projects, and permits managers to compare costs of wood addition (which at \$3/ft is relatively cheap) with benefits of fishery improvement. Their preliminary results show that trout abundance and biomass in several streams have doubled since treatment. Fishing participation and expenditures in Maine are substantial, providing \$250 million in economic output, \$18 million in state and local tax revenue, and 3,200 jobs. Brook trout fishing alone is valued at \$114 million, and 279,000 people hold Maine fishing licenses.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

### Outcome #24

#### 1. Outcome Measures

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

#### 2. Associated Institution Types

- 1862 Research

### 3a. Outcome Type:

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

**Outcome #25**

**1. Outcome Measures**

# of people improving their knowledge of the impacts of perturbations from invasive species and/or riparian zone management on the ecology of native Maine salmonids

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	100	100

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

**Outcome #26**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	10	10

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

**Outcome #27**

**1. Outcome Measures**

The distribution and abundance of migratory fish in Maine will increase

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

**Outcome #28****1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	3	1

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

Locally adapted trait variation is rarely addressed in wildlife conservation and management. The primary objective of work by MAFES researchers is to provide insights into locally adapted variation that can guide management of important aquatic resources in Maine and globally.

**What has been done**

MAFES scientists tackled two areas of research on Maine's arctic charr (*Salvelinus alpinus*). They continued monitoring population demography and trait variation of the Arctic charr population in Floods Pond under funding with the Bangor Water District. The researchers presented the results of this work in a meeting to water district staff and staff from the Maine Department of Inland Fish and Wildlife (MDIFW) to guide resource management. The other area of charr research involved working with MDIFW to draft a reclamation and restoration plan for a threatened population.

**Results**

Recognition of this adaptive resource has led to an increased emphasis on population-specific management in arctic charr. This culminated in an invitation to help draft a restoration plan for a threatened population that places preservation of the genetic integrity of that population above all other concerns.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
135	Aquatic and Terrestrial Wildlife

**Outcome #29****1. Outcome Measures**

Improved understanding of evolutionary ecology of fishes: adaptive variation and conservation

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

Locally adapted trait variation is rarely addressed in wildlife conservation and management. The primary objective of work by MAFES researchers is to provide insights into locally adapted variation that can guide management of important aquatic resources in Maine and globally.

**What has been done**

Work by MAFES scientists on evolutionary model systems focused this year on theoretical developments and a guppy animal model system. From a theoretical perspective, they collaborated with academics and resource managers from across the nation to develop a model of potential salmon responses to climate change. In the area of the guppy model system, the scientists have continued to experimentally analyze ways in which the evolutionary divergence of populations can influence their population performance and ecosystem effects.

**Results**

In 2009 these researchers published a paper showing that harvest by human beings drives faster rates of evolution than found in nature or other contexts involving human disturbance. This paper has already been cited 18 times in less than a year, hinting at the impact it is currently having on the people who are developing and implementing harvest policy worldwide.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
135	Aquatic and Terrestrial Wildlife

**Outcome #30****1. Outcome Measures**

Number of agencies modifying management plans to conserve habitat for Claytons copper butterfly

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	3

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

Claytons copper butterfly is listed as endangered and is known only from 13 sites worldwide in Maine and New Brunswick, Canada. The population size has never been estimated. The taxonomic distinctness of Claytons copper butterfly from the nominate Dorcas copper is controversial, which affects its status at the global level.

**What has been done**

A MAFES project is clarifying the taxonomic status of Claytons copper butterfly by analyzing morphological and genetic data. The population size at each site and in total will be estimated.

**Results**

This ongoing analysis of habitat characteristics required by the state-endangered Clayton's copper butterfly is being used to modify the approach to habitat management by the Maine Department of Inland Fisheries and Wildlife at two state Wildlife Management Areas, and by The Nature Conservancy and the U.S. Fish & Wildlife Service at an important Nature Conservancy site that is also crucial for a federally endangered species of orchid. Private citizen and forest land management landowners are kept informed about results of butterfly surveys and use of their land in north central and northwestern Maine in the Allagash area, which is raising awareness and interest in Maine's endangered species in that region.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

**Outcome #31****1. Outcome Measures**

Increasing community involvement in vernal pool mapping

**2. Associated Institution Types**

- 1862 Research

### 3a. Outcome Type:

Change in Action Outcome Measure

### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Amphibians play an important role in ecosystems, serving as both predators and prey for many other animals. Because of their importance in an ecosystem, the decline or extinction of their population has a significant impact on other organisms. Amphibians are regarded as good ecological indicators because they respond to slight changes in the environment. And amphibian population persistence and resistance to human-caused perturbations requires intact connections among aquatic habitats and the terrestrial matrix.

#### What has been done

MAFES ecologists have been actively engaged in educating Maine people about the importance of vernal pools in their communities. They have guided seven Maine Towns in a proactive mapping and assessment project where, using citizen scientists, they assessed 617 vernal pools to evaluate which are significant vernal pools under the new September NRPA Significant Vernal Pool regulations.

#### Results

This work with 7 towns on mapping and assessing vernal pools has resulted in a GIS data layer for vernal pools for each town and has educated landowners, volunteers, and town officials. The informational web page on the town projects and on vernal pool resources is used by state and federal wetland officials for training their enforcement personnel. The researchers have also received many inquiries from other towns wishing to initiate mapping projects. Most recently, New Brunswick, CA, has asked them to start a program in their province after visiting the project's web page. The researchers are also working on improving the remote sensing of vernal pools through a collaboration with Stantec, Inc., the company that did all the photointerpretation of the towns' resources.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

### Outcome #32

#### 1. Outcome Measures

Checklist of Maine's Forest Birds

#### 2. Associated Institution Types

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	1

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Wildlife abundance depends on resource availability and quality. How these factors influence individual growth, breeding success, and survival are largely unknown, particularly across different life history stages. Physiologic indicators of individual condition are needed to understand how Maine's migrant and resident birds are responding to events that occur before and after they arrive in Maine.

**What has been done**

MAFES scientists developed a checklist of Maine's forest birds.

**Results**

The Laboratory of Avian Biology's Pocket Checklist of Maine's Forest Birds--Birds of the Penobscot Experimental Forest/Maine University Forest was distributed during the national annual meeting of the Association of Field Ornithologists' hosted at UMaine and is available on the LAB webpages in a downloadable format. This checklist will help to increase the general public's knowledge and appreciation of birds in the several local forests by helping them to keep track of what birds can be seen in the area. The availability of the checklist may contribute to the growth of resource-based ecotourism.

**4. Associated Knowledge Areas**

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

**Outcome #33**

**1. Outcome Measures**

Solving Groundwater Quality and Quantity Issues in the Northeast with Citizen Science

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

In an area where the watershed faces significant issues from salinity in drinking water wells, effective tools for monitoring salinity are currently lacking, as are strategies for educating decision makers and households about improved water management strategies.

**What has been done**

MAFES researchers are taking part in a project that will deliver a comprehensive groundwater quality curriculum to K-12 schools while exploring the role of social capital within communities in the impact of student-collected data and the role of trust in student-collected information. This project will improve social science and water quality science knowledge among a variety of stakeholders; increase public awareness and involvement in water quality issues; and create opportunities for change within many communities, including those facing salinity issues.

**Results**

The four communities that the scientists have worked with so far have learned more about groundwater resources, private well water, and water quality testing. They have conducted four trainings with 24 people. Training participants expressed increased awareness and interest in local groundwater issues and solutions to address quality and quantity concerns. Training participants and additional GET WET! community volunteers generated community commissions, which appear to have long-term plans to continue beyond the study. To date, the trainings enabled 90 students and parents to participate in GET WET! and private well water screening for contaminants.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
134	Outdoor Recreation
608	Community Resource Planning and Development

**Outcome #34****1. Outcome Measures**

Discovery of potentially important flyway for songbirds crossing the Gulf of Maine

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Researchers believe they may have discovered a previously unknown, but potentially important flyway that songbirds are using as a shortcut across the Gulf of Maine during fall migration, according to wildlife biologists with the University of Maine and U.S. Fish and Wildlife Service's Maine Coastal Islands National Wildlife Refuge.

#### What has been done

According to a MAFES scientist, during a bird banding study on several national wildlife refuge islands last fall, more than 6,000 songbirds representing 75 species were captured, far exceeding the number captured at long-running banding stations elsewhere.

#### Results

The researchers estimate that up to a half million or more songbirds could be using the Metinic Island area on their way from the Canadian Maritimes to the southern Maine mainland. For the past two years, researchers from the Maine Coastal Islands National Wildlife Refuge and National Audubon Society have banded songbirds on Seal Island. The effort was expanded this past season (mid-August to mid-October) to the refuges on Petit Manan and Metinic islands.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

### V(H). Planned Program (External Factors)

#### External factors which affected outcomes

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

#### Brief Explanation

Certain investigators have retired or left the university. Some projects were terminated earlier than originally anticipated. Other projects were moved to a new program area. University has had several years of budget cuts, affecting ability to hire new or replacement faculty.

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

#### 1. Evaluation Studies Planned

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

**Evaluation Results**

{No Data Entered}

**Key Items of Evaluation**

{No Data Entered}

**V(A). Planned Program (Summary)****Program # 5****1. Name of the Planned Program**

Plant Production

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

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
101	Appraisal of Soil Resources			6%	
102	Soil, Plant, Water, Nutrient Relationships			28%	
111	Conservation and Efficient Use of Water			3%	
201	Plant Genome, Genetics, and Genetic Mechanisms			6%	
202	Plant Genetic Resources			17%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			7%	
204	Plant Product Quality and Utility (Preharvest)			5%	
205	Plant Management Systems			8%	
206	Basic Plant Biology			5%	
211	Insects, Mites, and Other Arthropods Affecting Plants			3%	
212	Pathogens and Nematodes Affecting Plants			5%	
213	Weeds Affecting Plants			1%	
215	Biological Control of Pests Affecting Plants			1%	
216	Integrated Pest Management Systems			1%	
305	Animal Physiological Processes			1%	
501	New and Improved Food Processing Technologies			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 (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	0.0	0.0	6.6	0.0
Actual	0.0	0.0	7.9	0.0

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

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b> 0	<b>1890 Extension</b> 0	<b>Hatch</b> 349814	<b>Evans-Allen</b> 0
<b>1862 Matching</b> 0	<b>1890 Matching</b> 0	<b>1862 Matching</b> 605006	<b>1890 Matching</b> 0
<b>1862 All Other</b> 0	<b>1890 All Other</b> 0	<b>1862 All Other</b> 724840	<b>1890 All Other</b> 0

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

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. Brief description of the target 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(E). Planned Program (Outputs)****1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	0	0	0	0
<b>Actual</b>	0	0	0	0

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

Year: 2009

Plan: 0

Actual: 0

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

2009	Extension	Research	Total
<b>Plan</b>	0	12	
<b>Actual</b>	0	6	0

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

## Output Target

### Output #1

#### Output Measure

- # of research projects completed

Year	Target	Actual
2009	4	4

### Output #2

#### Output Measure

- # of papers presented at professional meetings  
Not reporting on this Output for this Annual Report

### Output #3

#### Output Measure

- # of other types of publications

Year	Target	Actual
2009	9	20

## V(G). State Defined Outcomes

### V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of improved analytical methods developed to study dissolved organic matter in soils
2	# of candidate stress-related genes or alleles that are functionally characterized
3	% of Maine apple growers who increase their knowledge about most suitable rootstocks for Maine conditions
4	# of gene-based marker systems used for targeted introgression in potato-variety-improvement program
5	% of Maine potato growers adopting new recommendations (i.e., fertility programs, tissue-testing tools, crop rotation recommendations)
6	% of Maine apple growers planting winter-hardy, early-bearing rootstocks
7	Increase in profitability for Maine apple industry from a quicker return on investment and reduction in catastrophic tree losses (\$)
8	# of commercial-scale tests of new high-yielding, high-quality, and/or pest-resistant potato clones tested in Maine
9	# 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)
10	Decrease in percentage of leaf tissue samples with nitrogen and phosphorus deficiencies
11	Number of facilities propagating lowbush blueberry by tissue culture using information from this research
12	# of Maine lowbush blueberry growers learning about benefits of leaf sampling techniques to aid in fertility management decisions
13	Percentage of Maine lowbush blueberry growers surveyed who are changing their fertilization practices due to information provided by the fertility research program
14	# 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
15	# of new high-yielding, high-quality, and/or pest-resistant potato clones named and released by the Maine Potato Breeding Program
16	Percentage of Maine potato growers informed about promising new potato clones from the Maine Potato Breeding Program and other eastern programs
17	# of people improving their knowledge of the potential benefits of composting
18	Number of people surveyed using composts as a soil amendment to reduce organic waste volume and improve soil quality

19	# of Maine and New England vegetable growers learning about regionally adapted vegetable varieties
20	# of Maine vegetable growers learning about alternative crops and appropriate cultural management techniques for hoop house production
21	# of Maine vegetable growers learning about fall beds and the hybrid mulching system
22	# of Maine vegetable growers practicing crop rotation in hoop houses by growing alternative crops
23	# of Maine vegetable growers using fall made beds or hybrid mulching
24	Percentage of Maine vegetable growers that have improved management of their hoop houses
25	New, productive and pest-resistant potato varieties to enhance farm sustainability in the eastern U.S.
26	New techniques for woody plant breeding
27	Reducing potassium fertilizer use in potatoes
28	Changes in cover crop management by organic growers
29	Fertility advice for commercial greenhouse growers

## **Outcome #1**

### **1. Outcome Measures**

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

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	0	0

### **3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
101	Appraisal of Soil Resources

**Outcome #2**

**1. Outcome Measures**

# of candidate stress-related genes or alleles that are functionally characterized

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms

**Outcome #3**

**1. Outcome Measures**

% of Maine apple growers who increase their knowledge about most suitable rootstocks for Maine conditions

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	60	60

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

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

**Outcome #4**

**1. Outcome Measures**

# of gene-based marker systems used for targeted introgression in potato-variety-improvement program

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	1	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

The researchers found that modulated gene expression plays a crucial role in differential ability of Solanum species to cold acclimate. Downregulation of energy related genes indicates that Sc is able to adjust its metabolic

activities under sub-optimal condition better than St.

**Results**

The researchers found that modulated gene expression plays a crucial role in differential ability of Solanum species to cold acclimate. Downregulation of energy related genes indicates that Sc is able to adjust its metabolic activities under sub-optimal condition better than St.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms

**Outcome #5**

**1. Outcome Measures**

% of Maine potato growers adopting new recommendations (i.e., fertility programs, tissue-testing tools, crop rotation recommendations)

Not Reporting on this Outcome Measure

**Outcome #6**

**1. Outcome Measures**

% of Maine apple growers planting winter-hardy, early-bearing rootstocks

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	25	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

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

**Outcome #7****1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

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

**Outcome #8****1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	10	13

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results**

MAFES researchers coordinated 16 commercial-scale variety trials on Maine farms during 2009. These trials represented 13 new potato varieties (3 chippers, 5 russets, 2 reds, 1 speciality, 1 fresh market white, and 1 fresh market yellow fleshed) and 201 acres of production.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
211	Insects, Mites, and Other Arthropods Affecting Plants
701	Nutrient Composition of Food

**Outcome #9****1. Outcome Measures**

# 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. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	3	0

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

Over the past two years, 11 clones (7 russets, 1 long white, 3 round whites) have been submitted to Maine's tissue culture laboratory in preparation for commercial seed production.

**Results**

AF2291-10, an early blight-resistant clone with good chipping quality, began commercial-scale evaluation and seed increase during 2008. It is a candidate for naming and release during 2010. AF2574-1, a fresh market clone with good yields and late blight resistance, did well in its initial commercial test. AF3001-6 and AF3362-1 are being commercially evaluated as dual-purpose clones for french fry processing and fresh market. AF3317-15, a russet with good late blight and pink rot resistance, generated favorable results in a 2009 industry trial. Seed of

AF0338-17, a round-white that is widely adapted to eastern growing conditions, is being widely distributed to other eastern states so that it can attract interest among commercial seed growers.

**4. Associated Knowledge Areas**

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

**Outcome #10**

**1. Outcome Measures**

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

Not Reporting on this Outcome Measure

**Outcome #11**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
206	Basic Plant Biology

**Outcome #12****1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	100	100

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
206	Basic Plant Biology

**Outcome #13****1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	10	0

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

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
206	Basic Plant Biology

**Outcome #14****1. Outcome Measures**

# 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. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	10	17

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results****4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
211	Insects, Mites, and Other Arthropods Affecting Plants

## 701 Nutrient Composition of Food

**Outcome #15****1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

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

**Outcome #16****1. Outcome Measures**

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

Not Reporting on this Outcome Measure

**Outcome #17****1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	10	10

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
215	Biological Control of Pests Affecting Plants

**Outcome #18****1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
215	Biological Control of Pests Affecting Plants

**Outcome #19**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	250	250

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
205	Plant Management Systems

**Outcome #20**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	125	125

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
205	Plant Management Systems

**Outcome #21**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	100	100

### 3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

**What has been done**

**Results**

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

#### Outcome #22

##### 1. Outcome Measures

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

Not Reporting on this Outcome Measure

#### Outcome #23

##### 1. Outcome Measures

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

Not Reporting on this Outcome Measure

#### Outcome #24

##### 1. Outcome Measures

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

Not Reporting on this Outcome Measure

#### Outcome #25

##### 1. Outcome Measures

New, productive and pest-resistant potato varieties to enhance farm sustainability in the eastern U.S.

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

Potato growers in the East need new potato varieties that are highly productive and less susceptible to stress, diseases, and insects than current varieties. This regional potato breeding effort and trial network produces new potato varieties and evaluates their potential to serve fresh, processing, and specialty potato markets in the East.

**What has been done**

The MAFES breeding program focuses on russets and long whites for processing. Greenhouse crosses resulted in 118,000 true potato seeds representing 123 families. Seedling tubers from prior ME crosses and from germplasm exchanges with other breeding programs were planted in the field with 965 selected for continued evaluation in 2010. In advanced selection trials, 17 clones were retained in 2009 and continue to show potential for commercial development.

**Results**

These new varieties are expected to improve grower profitability by improving yields, market quality, and/or decreasing costs associated with pests. Given the scale and value of eastern potato production the impact of a successful new potato can mean many millions of dollars to the industry over a period of years. For example, potatoes can cost more than \$2000 per acre to produce and devastating diseases such as pink rot and/or late blight can totally destroy the crop. Resistant varieties greatly decrease the risk of such losses and, in the case of late blight resistance, can reduce production costs by reducing the number of chemical sprays applied to protect the crop from the pest. Over the years, the eastern regional project has resulted in the release of many commercially important potato varieties (e.g., Atlantic, Andover, Harley Blackwell, Kanona, Keuka Gold, MaineStay, Marcy, Monticello, Pike, and Sunrise). Peter Wilcox, a purple-skinned yellow-fleshed specialty variety from the USDA-ARS program, and Lehigh, a yellow-fleshed dual-purpose variety from NY, are the more recent releases from the eastern programs.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
202	Plant Genetic Resources
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 #26****1. Outcome Measures**

New techniques for woody plant breeding

**2. Associated Institution Types**

- 1862 Research

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Traditional woody plant breeding takes a long time. MAFES researchers are using molecular markers and rapid reproduction techniques to better guide their woody plant breeding and to rapidly regenerate new plants.

#### What has been done

A group of 48 inkberry accessions and two other Ilex species (Ilex crenata Thunb. and I. mutchagara Makino) were studied using AFLP markers. A total of 229 markers between 50 and 500 base pairs (bps) were produced from eight AFLP primer combinations. Among them, 87% of markers produced were polymorphic.

#### Results

Based on our Ilex glabra AFLP results, the genetic relationships within six cultivated groups were similar, and the opportunity to breed new plants within each group was much less than between the groups. These genetic markers could also be applied for the identification for existing or new cultivars. From their cold-hardiness research on Ilex glabra, the scientists recommend that Maine growers, select 'Shamrock' for production because it was the most cold-hardy cultivar. 'Compacta', 'Densa', 'Chamzin', 'Pretty Girl' should also be considered.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
206	Basic Plant Biology

### Outcome #27

#### 1. Outcome Measures

Reducing potassium fertilizer use in potatoes

#### 2. Associated Institution Types

- 1862 Research

#### 3a. Outcome Type:

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

Potato producers in the Northeast require management practices that will provide a high-quality product for new and expanding markets, while also optimizing yields under the region's variable soil and climatic conditions. Additionally, fertilizer and pesticide input costs have increased by approximately twofold over the past two years due to volatile energy markets. As a result, potato growers are increasingly focusing on ways to decrease their input costs and improve the sustainability of their farming operations.

**What has been done**

MAFES researchers conducted potassium fertilization experiments in potato plots and have used their results to revise potash fertilizer recommendations for potatoes during 2009.

**Results**

Their revised recommendations allow growers to choose between the previous build-and-maintain approach and a new sufficiency-level approach. On most soils, growers choosing the new approach will reduce their potash fertilizer application rates. Fertilizer savings are typically in the range of 60 kg of potash per ha. Our research indicates that yield and quality can be maintained with less fertilizer; however, growers will need to consider varietal characteristics and marketing criteria as they decide between the systems.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
503	Quality Maintenance in Storing and Marketing Food Products

**Outcome #28****1. Outcome Measures**

Changes in cover crop management by organic growers

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

Cover crops are commonly used for soil improvement, and nitrogen additions, but there is little information guiding farmers about the effects of timing or species choice in fulfilling their goals.

**What has been done**

A MAFES project has been examining a wide range of cover crop management and species choices to recommend the best combinations to accomplish various farming systems goals.

**Results**

The most significant outcome from this project was the unexpected data showing the enormously important contribution of perennial legume roots to both nitrogen and soil quality changes in the cropping system that relied on red clover. After several years of red clover roots, the following crop yields (broccoli) were actually significantly better when only roots and no aboveground biomass was incorporated into the soil. This has led to changes in management among organic growers who now feel more confident about removing red clover for hay before turning the stand in to plant a summer crop. Previous wisdom dictated that the entire plant needed to be turned in to get significant benefits. This adds an additional feed crop or sold commodity for those farms that follow this practice.

**4. Associated Knowledge Areas**

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

**Outcome #29****1. Outcome Measures**

Fertility advice for commercial greenhouse growers

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

In survey conducted at UMaine, organic and conventional growers indicated that fertility is a major concern for them in organic container production. Compost would be a renewable material that could serve as a substrate component and provide some fertility. However, composts in New England vary greatly from one supplier to the next, and some appear to be unsuitable as container media.

**What has been done**

MAFES researchers incorporated several New England composts into substrates for container-grown basil and marigolds.

## Results

The research determined that growth of plants in three of the tested commercially available composts was comparable to that in a conventional substrate with a starter fertilizer. No nutrient deficiencies were visible until 3 weeks after transplant. However, growth was minimal in plants grown in the other three composts. Physical and chemical analyses of the composts did not indicate any consistent reason for superior or inferior performance. In fact, sodium levels should have been toxic in some of the composts in which plants grew well. This indicates that composts are variable from one supplier to the next, and that growers should do on-site trials before incorporating composts into substrates.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water

## V(H). Planned Program (External Factors)

### External factors which affected outcomes

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

### Brief Explanation

Certain investigators have retired or left the university. Some projects were terminated earlier than originally anticipated. University has had several years of budget cuts, affecting ability to hire new or replacement faculty.

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

### 1. Evaluation Studies Planned

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

### Evaluation Results

{No Data Entered}

### Key Items of Evaluation

{No Data Entered}

**V(A). Planned Program (Summary)****Program # 6****1. Name of the Planned Program**

Plant Protection

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

## 1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
123	Management and Sustainability of Forest Resources			1%	
136	Conservation of Biological Diversity			3%	
201	Plant Genome, Genetics, and Genetic Mechanisms			1%	
202	Plant Genetic Resources			3%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			1%	
205	Plant Management Systems			16%	
206	Basic Plant Biology			1%	
211	Insects, Mites, and Other Arthropods Affecting Plants			9%	
212	Pathogens and Nematodes Affecting Plants			12%	
213	Weeds Affecting Plants			18%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants			1%	
215	Biological Control of Pests Affecting Plants			5%	
216	Integrated Pest Management Systems			16%	
311	Animal Diseases			6%	
605	Natural Resource and Environmental Economics			1%	
721	Insects and Other Pests Affecting Humans			6%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	5.2	0.0
Actual	0.0	0.0	4.7	0.0

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

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b> 0	<b>1890 Extension</b> 0	<b>Hatch</b> 293050	<b>Evans-Allen</b> 0
<b>1862 Matching</b> 0	<b>1890 Matching</b> 0	<b>1862 Matching</b> 634096	<b>1890 Matching</b> 0
<b>1862 All Other</b> 0	<b>1890 All Other</b> 0	<b>1862 All Other</b> 257592	<b>1890 All Other</b> 0

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

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. Brief description of the target audience**

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

**V(E). Planned Program (Outputs)****1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	0	0	0	0
<b>Actual</b>	0	0	0	0

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

Year: 2009

Plan: 0

Actual: 0

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

2009	Extension	Research	Total
<b>Plan</b>	0	10	
<b>Actual</b>	0	6	0

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

**Output Target****Output #1****Output Measure**

- # of other types of publications

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	8	36

**Output #2****Output Measure**

- # of papers presented at professional meetings
- Not reporting on this Output for this Annual Report

**Output #3****Output Measure**

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

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	2	1

**Output #4****Output Measure**

- # of Youtube channels for sharing results of research on weed control

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	{No Data Entered}	1

**Output #5****Output Measure**

- # of research blogs

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	{No Data Entered}	1

## V(G). State Defined Outcomes

### V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	% of potato growers familiar with effects of soil management on populations of insect
2	# of <i>Rhizoctonia solani</i> genes identified that express differentially under conditions of quinate-induced hypovirulence
3	# of <i>Rhizoctonia solani</i> genes identified that express differentially under conditions of genetically stable hypovirulence
4	# of <i>Rhizoctonia solani</i> genes identified that express differentially under conditions of virulence
5	# of Maine potato growers developing a better understanding of how the use of manure soil amendments and longer crop rotations affect potato insect and weed pests, and diseases and well as potato yield, quality, and profitability
6	# of Maine potato growers learning how to integrate animal-based production systems with their potato operations
7	percentage of Maine blueberry growers adopting and maintaining integrated pest management strategies
8	% of Maine blueberry acreage treated with perimeter tactics for control of blueberry maggot fly
9	# of alternative pest and soil management systems for potato that are ready for commercial-scale evaluation
10	% of organic and diversified vegetable farmers surveyed who have adopted weed seedbank management practices
11	% reduction in the amount of damage from blueberry maggot fly in treated fields vs nontreated fields
12	% reduction in the amount of organophosphate insecticides used to treat blueberry maggot fly in Maine
13	# of commercial-scale demonstrations with significant reductions in pesticide and fertilizer use and improvements in soil quality
14	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
15	Wild blueberry growers in Maine will be able to improve production by proper management of weed and disease pests
16	Wild blueberry growers in Maine will be able to properly identify and respond appropriately to weeds and diseases
17	Wild blueberry growers will make better management decisions on fertilizer and weed control
18	Integrated Pest Management for Fire Ants

19	Problems affecting honey bee health
20	Number of blueberry growers tracking mummy berry in their fields
21	Conserving native, natural enemies of blueberry pests
22	Protecting potato crops from pink rot
23	Reduction in herbicide use among Maine blueberry growers
24	New weed control tools for small vegetable growers

**Outcome #1****1. Outcome Measures**

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

Not Reporting on this Outcome Measure

**Outcome #2****1. Outcome Measures**

# of Rhizoctania solani genes identified that express differentially under conditions of quinate-induced hypovirulence

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	1	1

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
215	Biological Control of Pests Affecting Plants

#### Outcome #3

##### 1. Outcome Measures

# of Rhizoctonia solani genes identified that express differentially under conditions of genetically stable hypovirulence

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	0

##### 3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

**What has been done**

**Results**

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
215	Biological Control of Pests Affecting Plants

#### Outcome #4

##### 1. Outcome Measures

# of Rhizoctonia solani genes identified that express differentially under conditions of virulence

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
215	Biological Control of Pests Affecting Plants

**Outcome #5**

**1. Outcome Measures**

# of Maine potato growers developing a better understanding of how the use of manure soil amendments and longer crop rotations affect potato insect and weed pests, and diseases and well as potato yield, quality, and profitability

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	120	100

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants

## 216 Integrated Pest Management Systems

**Outcome #6****1. Outcome Measures**

# of Maine potato growers learning how to integrate animal-based production systems with their potato operations

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	120	100

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

**Outcome #7****1. Outcome Measures**

percentage of Maine blueberry growers adopting and maintaining integrated pest management strategies

Not Reporting on this Outcome Measure

**Outcome #8****1. Outcome Measures**

% of Maine blueberry acreage treated with perimeter tactics for control of blueberry maggot fly

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	15	87

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

Lowbush (wild) blueberries are an important and unique commercial crop in Maine and the blueberry maggot, or blueberry fruit fly, is the major insect pest of blueberries in Maine.

**What has been done**

MAFES scientists have been investigating the phenomenon of vertical movement of blueberry flies into trees and determining the implications of this movement on diffusion into blueberry field interiors and subsequent potential for jump dispersal over insecticide-treated field peripheries.

**Results**

Because of the results of this project, and educational programming and publications used to disseminate these results to Maine blueberry growers, 87% of Maine blueberry growers surveyed manage blueberry flies by a perimeter spray tactic. The survey suggests that this tactic saves 80% to 90% of the cost in managing the blueberry fly. Furthermore, since application to blueberry fields is reduced by 80% to 90%, the probability of environmental contamination is also been reduced. The specific outcomes resulting from the understanding of the vertical distribution of flies in trees has provided the ability for growers to fine-tune their perimeter spray tactic by applying spray swaths in the vicinity of attractive border trees (maple and oak).

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

**Outcome #9****1. Outcome Measures**

# of alternative pest and soil management systems for potato that are ready for commercial-scale evaluation

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

**Outcome #10**

**1. Outcome Measures**

% of organic and diversified vegetable farmers surveyed who have adopted weed seedbank management practices

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

## Results

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
213	Weeds Affecting Plants

#### Outcome #11

##### 1. Outcome Measures

% reduction in the amount of damage from blueberry maggot fly in treated fields vs nontreated fields

Not Reporting on this Outcome Measure

#### Outcome #12

##### 1. Outcome Measures

% reduction in the amount of organophosphate insecticides used to treat blueberry maggot fly in Maine

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	10	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Lowbush (wild) blueberries are an important and unique commercial crop in Maine and the blueberry maggot, or blueberry fruit fly, is the major insect pest of blueberries in Maine.

###### **What has been done**

MAFES scientists have been investigating the phenomenon of vertical movement of blueberry flies into trees and determining the implications of this movement on diffusion into blueberry field interiors and subsequent potential for jump dispersal over insecticide-treated field peripheries.

###### **Results**

Because of the results of this project, and educational programming and publications used to disseminate these results to Maine blueberry growers, 87% of Maine blueberry growers surveyed manage blueberry flies by a perimeter spray tactic. The survey suggests that this tactic saves 80% to 90% of the cost in managing the blueberry fly. Furthermore, since application to blueberry fields is reduced by 80% to 90%, the probability of environmental contamination is also been reduced. The specific outcomes resulting from the understanding of the vertical distribution of flies in trees has provided the ability for growers to fine-tune their perimeter spray tactic by applying spray swaths in the vicinity of attractive border trees (maple and oak).

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

**Outcome #13****1. Outcome Measures**

# of commercial-scale demonstrations with significant reductions in pesticide and fertilizer use and improvements in soil quality

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	1	1

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems

**Outcome #14****1. Outcome Measures**

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. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
213	Weeds Affecting Plants

**Outcome #15**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	100	100

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants

**Outcome #16**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	100	100

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants

**Outcome #17**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	100	100

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

What has been done

Results

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants

**Outcome #18**

**1. Outcome Measures**

Integrated Pest Management for Fire Ants

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Ants in the exterior urban/suburban landscape can cause considerable problems: stinging, homopteran-tending, and interior nuisance from invaders. The European fire ant is an invasive species that has become a serious pest in many coastal communities in northern New England over the past 10 years. Densities of this aggressive,

stinging ant can average 1.4 nests/m<sup>2</sup> with 300-10,000 foragers per nest. A need exists for an effective, yet safe means for managing populations of this pest and to prevent further spread.

**What has been done**

MAFES scientists have been working to develop a least-toxic strategy for homeowners and businesses for managing European fire ants, *Myrmica rubra*, using bait station strategies.

**Results**

Their results showed that bait deployed in the field was detected in ants up to 32 m from the delivery station. Broadcast of Advion fire ant bait and Pre-Empt liquid in AntPro bait stations both resulted in the lowest number of foragers, demonstrating that either a bait station strategy or a broadcast bait strategy can work to significantly reduce activity of *M. rubra* on infested properties if the right active ingredient and product are used. The researchers have been successful raising awareness of the differences between beneficial and pestiferous ants, providing stakeholders information about ant behavior, benefits that ants provide in managed ecosystems and consequences of control actions necessary for clients to make informed decisions about controlling ants in the landscape. Among the management techniques recommended, they make sure to include both cultural methods, and chemical methods. However, much of the emphasis is focused on prevention.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
216	Integrated Pest Management Systems
721	Insects and Other Pests Affecting Humans

**Outcome #19**

**1. Outcome Measures**

Problems affecting honey bee health

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The heavy reliance on insecticides for insect pest management may put honey bees at risk to exposure of harmful residues that compromise their health.

**What has been done**

MAFES entomologists designed field experiments to assess the potential of exposure to insecticide residues to honey bees for newly registered reduced risk insecticides that have low toxic effects on humans.

**Results**

Although the researchers found that there was little evidence for negative effects on honey bees when imidacloprid was applied just prior to blueberry bloom, they also made sure that honey bee keepers were aware of other studies that have shown deleterious effects of this chemical on honey bee larvae. Because of this information, some Maine blueberry growers have decided not to use imidacloprid, a neonicotinoid insecticide, when an alternative control is available for specific insect pest outbreaks. This course of action was recommended by the University of Maine Cooperative Extension until there is more information from across the country on all life stages of honey bees.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

#### Outcome #20

##### 1. Outcome Measures

Number of blueberry growers tracking mummy berry in their fields

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	{No Data Entered}	6

##### 3c. Qualitative Outcome or Impact Statement

###### Issue (Who cares and Why)

Lowbush blueberries are an important and unique commercial crop in Maine. Mummy berry disease caused by *Monilinia vaccinii-corymbosi* (Reade) Honey is the major disease problem of lowbush blueberry, but there are no studies of how the fungus progresses through the leaves and ultimately kills them.

###### What has been done

MAFES researchers have been examining the infection process of *Monilinia vaccinii-corymbosi*, the causal agent of mummy berry blight, in lowbush blueberry leaves.

###### Results

Approximately 130 growers attended meetings with the researchers and increased their knowledge about the mummy berry forecasting method and how to identify and control this disease. An informal poll showed that six growers had made mummy berry plots in their fields to track the fungus's progress in the spring.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

**Outcome #21****1. Outcome Measures**

Conserving native, natural enemies of blueberry pests

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

In Maine, lowbush blueberry is a native perennial crop. Natural enemies have evolved with the majority of insect pest species, yet insecticides are the predominant tactic used for pest management.

**What has been done**

As part of a multistate project, MAFES entomologists are assessing the natural enemy communities in blueberry production and developing pest management tactics that conserve natural enemies in blueberry fields. The researchers will also be examining the effectiveness of these natural enemies at suppressing native pest insects, focusing first on the Allegheny mound ant.

**Results**

After a presentation designed to acquaint blueberry growers with the biology and ecology of three species of mound ants that are common predators in wild blueberry fields in Maine, the researchers have seen a change in action by some organic lowbush blueberry growers. Some organic growers have begun to avoid mowing down ant mounds during their pruning operations--a conservation biocontrol management tactics that has been adopted by some of the "early adopters" in the blueberry grower community.

**4. Associated Knowledge Areas**

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

**Outcome #22****1. Outcome Measures**

Protecting potato crops from pink rot

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

Pink rot losses occur in potato throughout Maine and can be severe when heavy rains occur near harvest. This disease is both a field and a storage problem. Surveys indicate that resistance to the standard fungicide used for management of pink rot, mefenoxam, is nearly universal where it has been in continuous use in Maine, and is widespread where its use for late blight was discontinued. No other fungicides have demonstrated equivalent activity

**What has been done**

MAFES scientists evaluated fluopicolide (Presidio), cyazofamid (Ranman), and a numbered compound for pink rot (*Phytophthora erythroseptica*) control in an inoculated plot at the Aroostook Research Farm in Presque Isle, ME.

**Results**

This research includes critical evaluation of assessment systems for loss to pink rot as well as varietal rankings. To augment the search for replacement pink-rot control materials, the researchers are also conducting breeding research that is intended to produce resistant lines, illustrate the patterns of resistance/susceptibility to progeny for this disease, and to provide genetic material for marker selection. Several numbered lines from Maine's potato breeding program evaluated in 2009 have resistance equivalent to Atlantic, the standard cultivar most consistently resistant to the disease.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

**Outcome #23****1. Outcome Measures**

Reduction in herbicide use among Maine blueberry growers

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Weeds, diseases and vertebrate depredation reduce the yield and quality of wild blueberries.

**What has been done**

MAFES scientists conducted a spot-treatment trial assess the efficacy of a mesotrione/clethodim tank mix in controlling broadleaf weeds and grasses in wild blueberry (*Vaccinium angustifolium*) fields.

**Results**

This combination treatment allows for a postemergence application, thereby targeting the weeds as a spot treatment and combining both broadleaf and grass control with a single application. This will result in less herbicide use and a reduction in application cost for blueberry growers.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants

**Outcome #24**

**1. Outcome Measures**

New weed control tools for small vegetable growers

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

In 2005, there were 1.7 million small farms in the U.S. This number is likely to increase with the continued growth in demand for organic and locally produced foods. Although there is a broad array of innovative tools for tractor-mounted tool bars, many small growers do not own a tractor. Instead, they rely on walk-behind tractors or tillers, sometimes horses. Weed control is accomplished with the same tools that have been used for the past century.

#### What has been done

During the 2009 field season, MAFES researchers evaluated innovative cultivation equipment imported from Finland.

#### Results

The researchers imported from Finland the Weed Master, an innovative set of cultivation and flame-weeding equipment, designed and built by a team of Finnish small-scale organic farmers. This is the first unit to be imported to North America. Our on-farm field evaluations, along with a replicated comparison with widely available weeding tools, indicate that efficacy of weed control with the Weed Master is equal to hand weeding, hoeing or using a wheel hoe, but 60% to many times more efficient when working time is considered. The dramatically greater working speed translates directly into dollars saved weeding, and offers growers opportunity to cultivate several times to achieve a high level of weed control if necessary. The researchers also explored an innovative mechanism for sharing results through a research blog ([gallandt.wordpress.com](http://gallandt.wordpress.com)), and have developed a new YouTube Channel, "Zeroseedrain" (<http://www.youtube.com/user/zeroseedrain>), which features our preliminary evaluations of the Weed Master.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
213	Weeds Affecting Plants

### V(H). Planned Program (External Factors)

#### External factors which affected outcomes

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

#### Brief Explanation

Certain investigators have retired or left the university. Some projects were terminated earlier than originally anticipated. University has had several years of budget cuts, affecting ability to hire new or replacement faculty.

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

#### 1. Evaluation Studies Planned

- After Only (post program)

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

**Evaluation Results**

{No Data Entered}

**Key Items of Evaluation**

{No Data Entered}

**V(A). Planned Program (Summary)****Program # 7****1. Name of the Planned Program**

Animal Production and Protection

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

## 1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals			14%	
302	Nutrient Utilization in Animals			9%	
303	Genetic Improvement of Animals			7%	
304	Animal Genome			7%	
307	Animal Management Systems			8%	
308	Improved Animal Products (Before Harvest)			1%	
311	Animal Diseases			26%	
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			7%	
402	Engineering Systems and Equipment			7%	
	<b>Total</b>			100%	

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

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

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	5.4	0.0
Actual	0.0	0.0	6.7	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	431957	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	850439	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	326126	0

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

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. Brief description of the target audience**

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

**V(E). Planned Program (Outputs)****1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	0	0	0	0
<b>Actual</b>	0	0	0	0

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

Year: 2009

Plan: 0

Actual: {No Data Entered}

**Patents listed**

{No Data Entered}

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

2009	Extension	Research	Total
<b>Plan</b>	0	10	
<b>Actual</b>	0	10	0

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

- # of research projects completed, annually

Year	Target	Actual
2009	4	0

**Output #2**

**Output Measure**

- # of papers presented at professional meetings, annually

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	26	0

**Output #3**

**Output Measure**

- # of other types of publications, annually

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	8	0

## V(G). State Defined Outcomes

### V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of zebrafish models validated for use in toxicology studies and for testing new pesticides
2	# of new lab-scale protocols that accurately reflects farm-scale ensilage
3	# of new cost-benefit models for establishing mussel hatcheries for new mussel lines
4	# of DNA vaccines against infectious pancreatic necrosis virus developed and tested
5	# of thematic maps regarding incidence of lobster shell disease and other environmental factors
6	# of state agencies using findings on effects of contaminants in rivers on maturation of Maine salmon to develop BMPs for pesticide use
7	% of Maine dairy farmers sending samples to be measured for bovine placental lactogen (bPL) and using the results of samples to make management decisions involving their animals
8	# of crab-monitoring programs undertaken by coastal communities
9	# of Maine mussel growers using new submersible raft
10	# of new oyster lines with superior cold-water growth and disease resistance
11	% increase in Maine's clam catch levels
12	% increase in oyster seed from new lines being used by industry
13	% increase in mussel seed used for grow-out on commercial mussel farms
14	% increase in the fertility of marine broodfish (Atlantic cod and halibut)
15	% increase in the hatching rate of marine larval fish (Atlantic cod and halibut)
16	% increase in the viability of juvenile marine fish raised in captivity (Atlantic cod and halibut)
17	% reduction in the use of live food inputs in diets for larval marine fish
18	Geodesic sphere submersible fish pen

19	Methodology for juvenile sampling and testing of a commercial-sized pound as a hatchery
20	Investigating the potential for growing hatchery-produced scallops in Maine
21	Methods to Increase Reproductive Efficiency in Cattle
22	Controlling mastitis in dairy cows

**Outcome #1****1. Outcome Measures**

# of zebrafish models validated for use in toxicology studies and for testing new pesticides

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
304	Animal Genome

**Outcome #2****1. Outcome Measures**

# of new lab-scale protocols that accurately reflects farm-scale ensilage

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
302	Nutrient Utilization in Animals

**Outcome #3**

**1. Outcome Measures**

# of new cost-benefit models for establishing mussel hatcheries for new mussel lines

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
303	Genetic Improvement of Animals

**Outcome #4**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	2	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
311	Animal Diseases

**Outcome #5**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	35	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
312	External Parasites and Pests of Animals

**Outcome #6**

**1. Outcome Measures**

# of state agencies using findings on effects of contaminants in rivers on maturation of Maine salmon to develop BMPs for pesticide use

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
304	Animal Genome

**Outcome #7**

**1. Outcome Measures**

% of Maine dairy farmers sending samples to be measured for bovine placental lactogen (bPL) and using the results of samples to make management decisions involving their animals

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
301	Reproductive Performance of Animals

**Outcome #8**

**1. Outcome Measures**

# of crab-monitoring programs undertaken by coastal communities

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
312	External Parasites and Pests of Animals

**Outcome #9**

**1. Outcome Measures**

# of Maine mussel growers using new submersible raft

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	2	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Maine's aquaculture industry is faces constant change and challenges. The industry, however, is comprised of many small companies that do not have in-house engineering capabilities and/or cannot afford to hire consultants to respond to these issues.

#### **What has been done**

MAFES engineers have provided engineering R&D to meet this need and help to ensure the sustainability of an industry that has become an integral part of Maine's economy.

#### **Results**

In one project, individuals in the aquaculture industry identified a need to develop submersible mussel rafts for use in high wave energy sites or areas in which the rafts presented a hazard to navigation. The working group decided that the most appropriate action was to do scale-model testings in the University of Maine wave tank. After a series of models were tested and revised, we developed a full-scale prototype of the submersible mussel raft and deployed it in Upper Frenchman's Bay, Maine. The raft was a catamaran fabricated from large diameter polyethylene pipe and was raised and lowered using compressed air from a service boat. After some initial problems the operation was successful.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
402	Engineering Systems and Equipment

#### **Outcome #10**

##### **1. Outcome Measures**

# of new oyster lines with superior cold-water growth and disease resistance

##### **2. Associated Institution Types**

- 1862 Research

##### **3a. Outcome Type:**

Change in Action Outcome Measure

##### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	0	0

##### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Despite increased market demand for shellfish, sub-optimal grow-out conditions for oysters and increased competition with mussel imports negatively impact the viability of bivalve culture in Maine. MAFES researchers are working to increase the efficiency of oyster culture efforts in Maine through a selective breeding program for enhanced cold-water growth and disease resistance and explore the efficacy of hatchery-based production of mussels with unique morphological features in order to increase the market price commanded by Maine oysters.

#### **What has been done**

MAFES researchers conducted two common-garden grow-out trials, comparing the performance of the Univ. of Maine UMFS line to two other genetically improved lines, the NEH line from Rutgers University, and the FMF line from Frank M. Flowers Oyster Co.

**Results**

Impacts stemming from this project include the release of two new genetically improved lines of eastern oysters to industry hatcheries in 2007. These lines had up to 5-6% faster growth and more uniform growth when compared to the line typically used by Maine's oyster culture industry. Improved growth is expected to increase yields and reduce the average time to market for farms adopting the new line.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
303	Genetic Improvement of Animals

**Outcome #11**

**1. Outcome Measures**

% increase in Maine's clam catch levels

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
312	External Parasites and Pests of Animals

**Outcome #12****1. Outcome Measures**

% increase in oyster seed from new lines being used by industry

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

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

Oyster lines developed in Maine may have limited application outside of the state and limit seed sales by Maine hatcheries to farms in other states.

**What has been done**

Recent work by MAFES scientists on cross-breeding between oyster lines for combined disease resistance has proven quite promising. Disease is the major impediment to increased yields in the culture of eastern oysters. Their work on cross-breeding provides a solid foundation for the continued hybridization among existing genetically improved oyster lines. The researchers constructed a small set of backcross mapping families between the UMFS and NEH stocks and in collaboration with Ximing Guo at Rutgers University, we monitored the mortality of these families at sites where the diseases ROD and Dermo are prevalent.

**Results**

Through this work, MAFES scientists expect to produce and eventually release lines with improved disease resistance that should result in increased yields approaching 10-20% at oyster farms throughout the northeastern U.S. Furthermore, the production of oyster families through specific pair matings (backcross mapping families) has provided genetic material that will increase the pace of studies identifying genes associated with disease resistance in eastern oysters. This work can contribute to marker-assisted selection in oysters, an approach that will further increase the pace of genetic improvement for Maine's oyster culture industry.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
303	Genetic Improvement of Animals

**Outcome #13**

**1. Outcome Measures**

% increase in mussel seed used for grow-out on commercial mussel farms

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

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

**What has been done**  
{No Data Entered}

**Results**  
{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
303	Genetic Improvement of Animals

**Outcome #14**

**1. Outcome Measures**

% increase in the fertility of marine broodfish (Atlantic cod and halibut)

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

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

Improper feeding and inadequate diets during all life stages (broodfish, larvae and juvenile) can result in poor production performance. The cost of feed represents approximately 50% of the production cost of aquatic animals. Understanding nutrient requirements and increasing the nutritional value of feeds will improve growth and other production parameters, and development of feeds that provide good nutrition while using cost effective ingredients will lower production cost.

**What has been done**

MAFES researchers conducted a series of experiments to determine the effects of dietary n-3 highly unsaturated fatty acids (HUFA) on flame angelfish egg and larval quality. Formulated diets containing 1.84, 2.97 or 3.63% n-3 HUFA were fed to flame angelfish broodfish for 5 months. In the second experiment, formulated diets containing higher levels of n-3 HUFA (2.67, 3.48 or 4.34%) were fed to flame angelfish broodfish for 5 weeks.

**Results**

Flame angelfish that were fed the diet containing 3.63% n-3 HUFA exhibited significantly increased fecundity, fertilization rates and egg viability than fish that were fed the other two formulated diets. Furthermore, egg diameter, oil globule diameter, larval size at hatch, percent survival to yolk-exhaustion, and size at yolk-exhaustion from fish that were fed the diet containing 3.63% n-3 HUFA were not significantly different from that of fish fed the Control diet.

**4. Associated Knowledge Areas**

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

**Outcome #15****1. Outcome Measures**

% increase in the hatching rate of marine larval fish (Atlantic cod and halibut)

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
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2009 0 0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

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

**Outcome #16**

**1. Outcome Measures**

% increase in the viability of juvenile marine fish raised in captivity (Atlantic cod and halibut)

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

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

**Outcome #17**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

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

**Outcome #18****1. Outcome Measures**

Geodesic sphere submersible fish pen

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

Maine's aquaculture industry is faces constant change and challenges. The industry, however, is comprised of many small companies that do not have in-house engineering capabilities and/or cannot afford to hire consultants to respond to these issues.

**What has been done**

MAFES engineers have provided engineering R&D to meet this need and help to ensure the sustainability of an industry that has become an integral part of Maine's economy.

**Results**

A geodesic sphere submersible fish pen was modified in the University of Maine wave tank and scaled up to a full-size prototype. The cage was stocked with fish in the summer and performance was monitored for ease of operation, growth rate of the fish, and economic feasibility. A second prototype was fabricated and stocked with Cobia. This unit proved to be a success and several additional orders were placed to acquire more of these pens. A television company made a special program showing the submerging and recovery of the sphere and fish have been raised and sold as a result of this project.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
402	Engineering Systems and Equipment

**Outcome #19****1. Outcome Measures**

Methodology for juvenile sampling and testing of a commercial-sized pound as a hatchery

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Maine's aquaculture industry is faces constant change and challenges. The industry, however, is comprised of many small companies that do not have in-house engineering capabilities and/or cannot afford to hire consultants to respond to these issues.

**What has been done**

MAFES engineers have provided engineering R&D to meet this need and help to ensure the sustainability of an industry that has become an integral part of Maine's economy.

**Results**

MAFES researchers investigated the feasibility of hatching lobsters in tidal pounds for release for stock enhancement. Approximately 20 lobsters with eyed eggs were raised in each of two pounds. The larval lobsters were allowed to grow to Stage 4 or 5 and after counting were released from the pound. Juvenile sample traps were located in the area and local lobstermen were recruited to tend the traps and record the data. Although the results indicated high loss of juvenile lobster, the positive outcome is that the work led to the development of a methodology for juvenile sampling and the testing of a commercial-sized pound as a hatchery. A public seminar on the sampling trap was held, paving the way for cooperative efforts between industry and university researchers for further work on this issue.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
402	Engineering Systems and Equipment

**Outcome #20**

**1. Outcome Measures**

Investigating the potential for growing hatchery-produced scallops in Maine

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

Maine's aquaculture industry is faces constant change and challenges. The industry, however, is comprised of many small companies that do not have in-house engineering capabilities and/or cannot afford to hire consultants to respond to these issues.

**What has been done**

MAFES engineers have provided engineering R&D to meet this need and help to ensure the sustainability of an industry that has become an integral part of Maine's economy.

**Results**

MAFES researchers have explored the potential for growing hatchery-produced scallops. Through a collaborative process, the group formulated the hypothesis that hatcheries needed fencing in areas of the sea bottom that would keep the highly motile scallops in and predators out. We conducted a research project in which we collected scallops after one growing season from within and without the fence and subjected them to a procedure that tested the strength and thickness of the scallop shells (based on an ASTM test procedure). Preliminary results indicated that scallops outside the fenced area had greater shell thickness and strength compared to scallops located within the fenced area. We hypothesized that the presence of predators prompted the unfenced scallops to develop stronger, thicker shells. These findings lay the groundwork for future research to enhance efforts to develop a scallop hatchery industry.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
402	Engineering Systems and Equipment

**Outcome #21****1. Outcome Measures**

Methods to Increase Reproductive Efficiency in Cattle

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Owners of commercial dairy herds cannot efficiently produce calves because a high percentage of milking cows do not have consistent estrous cycles for much of early lactation.

**What has been done**

MAFES animal scientists are taking part in multistate project NC1038. This project focuses on the development of methods that effectively synchronize estrous in postpartum beef and dairy cows by decreasing the period of time over which estrous detection is required, thus facilitating the use of timed artificial insemination.

**Results**

The project has found that increasing pregnancy rates in resynchronized cows diagnosed not pregnant after a previous insemination would result in fewer cull cows, more calves, and greater milk production. Cost of that cull is the cost of her replacement minus the market value of the cull sold at the sale barn times the remaining proportion of her expected herd life. For example, the average cost of a replacement cow was \$1,290, and the value of the cull cow sold at the sale barn is approximately \$500. So for every cow culled from the herd, the loss averages \$790. But the loss does not end there because the new cow is generally 2-year-old that will produce less milk. Therefore, the loss from each cow culled can easily reach \$1,000. The identification of high-quality phenotypes associated with heifer fertility is the first and most crucial step towards developing genetic markers for heifer fertility and cow stayability. We have identified antral follicle count and reproductive tract scores as potential phenotypes which can predict heifer fertility to be used in whole genome scans with the bovine 50K SNP Chip for the identification of genetic markers of heifer fertility.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
301	Reproductive Performance of Animals

**Outcome #22****1. Outcome Measures**

Controlling mastitis in dairy cows

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

Mastitis continues to be a major economic risk, capable of devastating the small or large dairy operation. Prevention and control have relied on hygiene during and between milkings, antibiotic treatment or teat sealants during the dry period, antibiotic treatment of clinically detectable mastitis, and culling of seriously affected cattle. Due to human health concerns, dairy farmers follow strict regulations, and are encouraged to avoid exogenous chemicals or drugs. To reduce the need for antibiotics, both innate and adaptive immune responses can be

activated in the mammary gland. In innate immunity, the role of "normal flora" on the skin and mucosal surfaces can be vital: "good" bacteria can kill, or simply outcompete, pathogens. That normal flora, if augmented following each disruption by milking, might help form a defense against pathogens. This project will evaluate normal flora of the teat skin, and attempt to augment innate defenses by enhancing that flora between milkings and question whether that flora can increase innate host cellular defenses against pathogens.

#### **What has been done**

In the last year, the primary outcomes from work on this project have been to establish a group of potential endogenous probiotics. Secondary outcomes are related to technique development.

#### **Results**

In initial screening of endogenous flora, MAFES scientists were able to identify a total of 33 teat skin bacterial isolates, and 27 streak milk bacterial isolates. Of these, most were bacillus, arthobacter or coagulase negative staph (CNS) species. Of these, three have shown substantial inhibition of known mastitis pathogens in vitro to date. Biofilm testing is underway. Further testing, including in vitro toxicity and efficacy, will be completed prior to tests of in vivo application. Producer groups have indicated interest in this product, especially as an adjunct to organic dairy applications.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

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

##### **External factors which affected outcomes**

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

##### **Brief Explanation**

Certain investigators have retired or left the university. Some projects were terminated earlier than originally anticipated. University has had several years of budget cuts, affecting ability to hire new or replacement faculty.

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

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

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

**Evaluation Results**

{No Data Entered}

**Key Items of Evaluation**

{No Data Entered}

**V(A). Planned Program (Summary)****Program # 8****1. Name of the Planned Program**

Foods and Nutrition

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

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
204	Plant Product Quality and Utility (Preharvest)			20%	
308	Improved Animal Products (Before Harvest)			4%	
501	New and Improved Food Processing Technologies			21%	
502	New and Improved Food Products			10%	
503	Quality Maintenance in Storing and Marketing Food Products			5%	
702	Requirements and Function of Nutrients and Other Food Components			30%	
703	Nutrition Education and Behavior			10%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	0.0	0.0	4.8	0.0
Actual	0.0	0.0	2.1	0.0

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

<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	120727	0
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	208422	0
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	0	0

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

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. Brief description of the target audience

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

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

#### 1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

##### Patent Applications Submitted

Year: 2009

Plan: 0

Actual: {No Data Entered}

##### Patents listed

{No Data Entered}

#### 3. Publications (Standard General Output Measure)

##### Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	9	
Actual	0	9	0

### V(F). State Defined Outputs

#### Output Target

##### Output #1

###### Output Measure

- # of other publications

Year	Target	Actual
2009	7	0

##### Output #2

###### Output Measure

- # of papers presented at meetings

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	20	0

**Output #3**

**Output Measure**

- # of websites on phytonutrients

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	0	0

**Output #4**

**Output Measure**

- # of completed research projects

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	2	0

## V(G). State Defined Outcomes

### V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of new crab-protein-based products developed
2	# of new natural antimicrobials developed from fruits and/or vegetables
3	% of Maine food processors learning about principles of food safety programs
4	# of new analytical methods for detecting phytochemicals in foods
5	# of Maine food processors learning about new methods to detect pesticide residues
6	% of Maine food processors establishing their own HACCP plans
7	% of Maine food processors adopting new technologies to reduce microbial contamination of food products
8	% of acreage planted of acreage planted to new apples varieties that have greater consumer appeal
9	Increase in fruit and vegetable consumption by Maine seniors
10	Increase in consumption of fruits and vegetables by targeted young adults
11	Decrease in obesity among young adults taking part in nutrition education program
12	# of food products incorporating nutrition claims of interest to consumers
13	# of new extruded food products containing anthocyanins
14	Number of people newly aware of the health benefits of potatoes
15	Percentage increase in wild blueberry sales
16	Percentage of Maine adults who are overweight or obese
17	Demonstrating that wild blueberries improve vasomotor tone

**Outcome #1****1. Outcome Measures**

# of new crab-protein-based products developed

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	2	0

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

One of Maine's greatest natural resources, and a major contributor to the state's economy, is the sea. The survival of the seafood and aquaculture industries, in Maine and throughout the U.S., is tied to their long-term economic and environmental sustainability. Maine shellfish growers and commercial fishermen are concerned about the green crab, an invasive predator that consumes clams, oysters, and mussels, and preys on the young of valuable fish species. Due to their small size, however, green crabs are not harvested and processed for human consumption. Although they are edible, it is not cost effective to pick their meat out by hand, as is done in the commercial processing of other local crab.

**What has been done**

MAFES food scientists are trying to find an economically feasible method of using the green crab in new food products, and thereby help establish a new fishery for this marine resource. The researchers are developing a mechanical separation method for green crab to produce minced meat, which can then be used in a variety of seafood products.

**Results**

During the first year of this project, the scientists have focused on developing methods to thermally process and mechanically separate the muscle from harvested green crab to optimize yield and quality of the extracted meat, while ensuring the safety of the product. They are currently developing a southwestern-style crab empanada, which will be tested for consumer acceptability in the Consumer Testing Center. The anticipated outcomes of this project are an economically feasible use for green crab that will bring added value to the efforts of fishermen and provide a worthwhile use of what is presently considered a nuisance marine species. There is currently no fishery for green crab, and the scientists anticipate that their industry collaborator will be the first to harvest and market green crab, and potentially partner with a local crab processor to produce minced crab meat. The harvest of green crab can increase income of lobstermen in the face of more stringent lobster fishing regulations and lead to an increase in crustacean processing businesses in Maine.

**4. Associated Knowledge Areas**

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

## 503 Quality Maintenance in Storing and Marketing Food Products

**Outcome #2****1. Outcome Measures**

# of new natural antimicrobials developed from fruits and/or vegetables

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	2	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
502	New and Improved Food Products

**Outcome #3****1. Outcome Measures**

% of Maine food processors learning about principles of food safety programs

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	60	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
502	New and Improved Food Products

**Outcome #4**

**1. Outcome Measures**

# of new analytical methods for detecting phytochemicals in foods

Not Reporting on this Outcome Measure

**Outcome #5**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	3	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
502	New and Improved Food Products

**Outcome #6**

**1. Outcome Measures**

% of Maine food processors establishing their own HACCP plans

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	60	0

**3c. Qualitative Outcome or Impact Statement**

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

**What has been done**  
{No Data Entered}

**Results**  
{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
502	New and Improved Food Products

**Outcome #7**

**1. Outcome Measures**

% of Maine food processors adopting new technologies to reduce microbial contamination of food products

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	25	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
502	New and Improved Food Products

**Outcome #8**

**1. Outcome Measures**

% of acreage planted of acreage planted to new apples varieties that have greater consumer appeal

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products

**Outcome #9**

**1. Outcome Measures**

Increase in fruit and vegetable consumption by Maine seniors

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Despite the importance of fruit, vegetable and whole grain intake in maintaining health and functional status, older adults are not meeting minimum dietary recommendations. Healthy People 2010: Objectives for Improving Health (HP2010) has set specific goals for Americans relative to fruit, vegetable and whole grain intake based on a broad scientific consensus. However, the Continuing Survey of Food Intakes by Individuals (CSFII) found that only about one-third of adults over the age of 60 consumed the recommended number of servings of fruit per day, half consumed the minimum daily number of vegetable servings, and about 40% consumed the minimum recommended servings of grains, including whole grains. Furthermore, only a fraction of those seniors surveyed selected vegetables and grain-based foods considered to be good sources of protective food constituents such as fiber and antioxidants.

**What has been done**

MAFES nutritionists have been assessing the impact of a farm-to-table approach to improving diets of older adults, the Senior Farmers' Market Nutrition program, as a way to promote the purchase of locally grown produce and to increase fruit and vegetable intake by Maine seniors.

**Results**

The scientists found that FarmShare participants over 12 weeks received more than 3 servings of fruits and vegetables per day. Furthermore, while receiving fresh produce, participants had fewer difficulties in paying for

necessities such as prescription medications, electricity, phones and heat. Homebound individuals were fortunate to have deliveries from farmers and positive health aspects were reported from availability of fresh fruits and vegetables. Feedback from the FarmShare experience showed 6 major domains on how the program affected individuals. Many with health issues felt a beneficial affect to their health concerns. Those with budget problems ate a greater variety and quantity of fresh fruits and vegetables than would normally be possible. Often, seasonality was extended through canning and freezing of the produce.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior

**Outcome #10**

**1. Outcome Measures**

Increase in consumption of fruits and vegetables by targeted young adults

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

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

**What has been done**  
{No Data Entered}

**Results**  
{No Data Entered}

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
703	Nutrition Education and Behavior

**Outcome #11**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
703	Nutrition Education and Behavior

**Outcome #12**

**1. Outcome Measures**

# of food products incorporating nutrition claims of interest to consumers

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
502	New and Improved Food Products
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior

**Outcome #13**

**1. Outcome Measures**

# of new extruded food products containing anthocyanins

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
502	New and Improved Food Products
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior

**Outcome #14**

**1. Outcome Measures**

Number of people newly aware of the health benefits of potatoes

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	100	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
502	New and Improved Food Products
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior

**Outcome #15**

**1. Outcome Measures**

Percentage increase in wild blueberry sales

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
502	New and Improved Food Products
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior

**Outcome #16**

**1. Outcome Measures**

Percentage of Maine adults who are overweight or obese

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
------	---------------------	--------

2009

56

0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)****What has been done****Results****4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
502	New and Improved Food Products
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior

**Outcome #17****1. Outcome Measures**

Demonstrating that wild blueberries improve vasomotor tone

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	{No Data Entered}	0

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

Scientific studies have produced substantial evidence linking the consumption of antioxidant-containing fruits and vegetables to reduced risk of cardiovascular disease (CVD) and improved cardiovascular health. Blueberries have the highest antioxidant capacity of all fruits and vegetables and Maine is the largest producer of wild blueberries in the country. The effect of blueberries in preventing CVD by reducing some of its risk factors is of critical importance to public health and in accordance with the goals stated by the USDA to characterize the mode of action of dietary components and describe their effects on the cardiovascular system. Results from this project may have great economic impact on the blueberry industry by increasing marketability and blueberry consumption in the United States.

**What has been done**

MAFES researchers are studying the effect and mechanism of action of wild blueberries in an animal model. The long-term goal would be to incorporate these foods and bioactive compounds into preventive strategies that reduce degenerative diseases.

**Results**

The researchers documented that in the young adult spontaneously hypertensive rats, 8 week wild blueberry consumption, decreases vascular resistance and improves vascular tone by modulating the COX pathway, which may have implications for prevention and/or treatment of pathologies. This is the first study to demonstrate that wild blueberries improve vasomotor tone in the young adult SHR and may be a potentially beneficial treatment for endothelial dysfunction.

#### 4. Associated Knowledge Areas

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

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

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

##### Brief Explanation

Certain investigators have retired or left the university. Some projects were terminated earlier than originally anticipated. Other projects were moved to a new program area. University has had several years of budget cuts, affecting ability to hire new or replacement faculty.

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

##### 1. Evaluation Studies Planned

- After Only (post program)
- Before-After (before and after 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.

##### Evaluation Results

{No Data Entered}

##### Key Items of Evaluation

{No Data Entered}

**V(A). Planned Program (Summary)****Program # 9****1. Name of the Planned Program**

Economics, Marketing, Policy and Community Development

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

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
134	Outdoor Recreation			9%	
501	New and Improved Food Processing Technologies			4%	
601	Economics of Agricultural Production and Farm Management			8%	
603	Market Economics			19%	
604	Marketing and Distribution Practices			3%	
605	Natural Resource and Environmental Economics			29%	
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 (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	0.0	0.0	4.9	0.0
Actual	0.0	0.0	5.4	0.0

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

<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	0	414044	0
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	0	482264	0
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	389682	0

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

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. Brief description of the target audience**

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

**V(E). Planned Program (Outputs)****1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Year: 2009

Plan: 0

Actual: {No Data Entered}

**Patents listed**

{No Data Entered}

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

2009	Extension	Research	Total
Plan	0	9	
Actual	0	9	0

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

- # of other types of publications

Year	Target	Actual
2009	8	0

**Output #2**

**Output Measure**

- # of papers presented at professional meetings

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	24	0

**Output #3**

**Output Measure**

- # of research projects completed

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	0	0

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

O. No.	OUTCOME NAME
1	# of people increasing their understanding of ongoing changes in the food system, annually
2	# of people increasing their understanding of factors affecting the profitability of Maine farming, annually
3	# of policies or programs adopted by state that promote local agricultural production
4	# of state-level committees, task forces, or commissions that integrate economic information into agricultural regulatory activities
5	% of natural resource managers surveyed who will use spatial data on land management, land use, and land ownership in Maine
6	% of Maine cruise ship passengers who will visit <a href="http://www.freestaymaine.com">www.freestaymaine.com</a> Web site, annually
7	# of "freestayMaine" vouchers that are redeemed per year by cruise ship passengers who are returning to Maine for a land-based vacation
8	# of Maine farms joining networks of local food producers and food-buying institutions
9	# of people developing a better understanding of land management, land use, and land ownership in Maine
10	Better understanding of the effects on behavior of health labeling
11	Virtual online conference on Maine's economy

**Outcome #1**

**1. Outcome Measures**

# of people increasing their understanding of ongoing changes in the food system, annually

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	300	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
604	Marketing and Distribution Practices
606	International Trade and Development

**Outcome #2**

**1. Outcome Measures**

# of people increasing their understanding of factors affecting the profitability of Maine farming, annually

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	250	0

**3c. Qualitative Outcome or Impact Statement**

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

**What has been done**  
{No Data Entered}

**Results**  
{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
606	International Trade and Development

**Outcome #3**

**1. Outcome Measures**

# of policies or programs adopted by state that promote local agricultural production

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	1	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**  
Agricultural research is underfunded relative to the needs of future food production systems. This project examines the effectiveness of agricultural research at meeting future world food needs and sustaining the resource

environment.

### What has been done

As part of this multistate research project, MAFES economists conducted a dairy cost-of-production study, which is used by the state of Maine to reduce the short-run risk of failure among Maine's dairy farms. Specific research activities include conducting surveys, assessment of the survey and analysis, as well as educating a public milk commission on the results. The research helps the State run a program designed to bridge Maine dairy farmers over temporary catastrophic declines in national (and thus regional) milk prices. The investigator has been asked multiple times to present and discuss results with members of the Maine state legislative agricultural committee.

### Results

The cost of dairy production results have been incorporated into state price support legislation. The research supported four levels of production for the first time, and a fourth level of production was officially adopted by the Maine Milk Commission. The results also are directly incorporated into the Maine State milk price support system, which is designed to bridge milk producers over periods of catastrophically low milk prices. Reducing the income fluctuation resulting from the whims of the international and national milk market, improves the quality of life for Maine milk producers and helps preserve Maine's rural communities and open spaces.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices
606	International Trade and Development

## Outcome #4

### 1. Outcome Measures

# of state-level committees, task forces, or commissions that integrate economic information into agricultural regulatory activities

### 2. Associated Institution Types

- 1862 Research

### 3a. Outcome Type:

Change in Action Outcome Measure

### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	1

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

The industrialization of the U.S. agricultural and food system has been transforming U. S. society in diverse ways for the past 70 years. Food has become cheaper, labor has been freed for other uses, and many rural communities have disappeared, and American production agriculture has become increasingly dualistic. One end of the spectrum is inhabited by small, often part-time farms that have developed direct marketing relationships with local food customers. The other end of the spectrum has large farms linked through commodity markets or contracts to consolidated food and fiber agribusinesses that mass market undifferentiated agricultural commodities around the globe. Farms and ranches in the "middle" are often not in a position to direct market, and are increasingly unable to compete successfully in global commodity markets. Not only are farms/ranches-of-the-middle increasingly at risk,

but midsize, regional food processors and distributors and even regional supermarket chains are now being bought or squeezed out of business.

**What has been done**

As part of this multistate project, MAFES economists worked with the Maine legislature on a dairy stabilization program, including providing impact assessments on farm types and size of various stabilization program modifications.

**Results**

Working with the Maine legislative leadership, the Joint Standing Committee on Agriculture, Conservation and Forestry, and members of the Joint Standing Committee on Appropriation, modifications of the dairy stabilization program were developed that met appropriation constraints while continuing the stabilization program that has a substantial impact on all dairy farms and the dairy industry in Maine, helping to keep more Maine dairy farms in business and providing jobs for rural communities with a secondary benefit of preserving Maine's rural landscape.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
606	International Trade and Development

**Outcome #5**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

**KA Code**    **Knowledge Area**  
 605            Natural Resource and Environmental Economics

**Outcome #6**

**1. Outcome Measures**

% of Maine cruise ship passengers who will visit www.freestaymaine.com Web site, annually

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	20	0

**3c. Qualitative Outcome or Impact Statement**

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

**What has been done**  
 {No Data Entered}

**Results**  
 {No Data Entered}

**4. Associated Knowledge Areas**

**KA Code**    **Knowledge Area**  
 608            Community Resource Planning and Development

**Outcome #7**

**1. Outcome Measures**

# of "freestayMaine" vouchers that are redeemed per year by cruise ship passengers who are returning to Maine for a land-based vacation

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	5000	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
608	Community Resource Planning and Development

**Outcome #8**

**1. Outcome Measures**

# of Maine farms joining networks of local food producers and food-buying institutions

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	25	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
604	Marketing and Distribution Practices
606	International Trade and Development

**Outcome #9**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	100	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
605	Natural Resource and Environmental Economics

**Outcome #10****1. Outcome Measures**

Better understanding of the effects on behavior of health labeling

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

The function of product information approaches (e.g., labeling and social marketing) is to improve the flow of information to consumers who, in turn, alter their information search and or product purchase behaviors.

**What has been done**

MAFES economists use consumer and economic research methods (1) to elicit stated preference methods used to determine individuals willingness-to-pay for changes in risk and other non-marketed attributes; (2) to devise research that leads to the appropriate design of various information policies and strategies; (3) to compare consumer reactions to various food processing technologies and determine the factors influencing their reactions; and (4) to examine the factors that explain trends in peoples food safety knowledge, perceptions and behaviors.

**Results**

MAFES economists found a fish consumption advisory aimed at reducing fish consumption risks (mercury consumption) led to some women reducing the amount of fish they ate (an undesired effect since eating fish provides health benefits), but it also successfully increased women's mercury-related knowledge, improved their perceptions of fish consumption risks and induced appropriate switching behavior, i.e., women reading the advisory decreased their consumption of high-risk fish and increased their consumption of low-risk fish. The researchers conclude a well-designed advisory can successfully transform a complex risk/benefit message, leading to appropriate knowledge and behavior changes.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
603	Market Economics
607	Consumer Economics
703	Nutrition Education and Behavior

**Outcome #11****1. Outcome Measures**

Virtual online conference on Maine's economy

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

Rural communities are comprised of people, their businesses and farms, their organizations and governance. The quality of rural life affects and is affected by the movement of people into and out of rural communities, the evolution of agriculture and industry, local social organization, and public policy. The future of rural America depends on decisions made by citizens, businesses and government officials at all levels. While much of the activity is local, many of the challenges and issues are common across counties and states. Citizens and policymakers alike are in need of high-quality, timely research and outreach to help them understand the forces shaping their communities and the role of public policy in addressing these changes.

**What has been done**

In early 2009, MAFES economists launched a virtual on-line conference titled "Building a Vibrant Maine Economy (VME)." The conference included four research presentations and several other taped segments, and presented MAFES research on aspects of the creative and knowledge economies.

**Results**

The presentations of the "Vibrant Maine Economy" conference informed policymakers and other interested stakeholders about strategies to increase the productivity and wages of Maine workers. A "cabinet-level" Maine policymaker has stated that this information is being used in presentations across the state.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
608	Community Resource Planning and Development

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

### **External factors which affected outcomes**

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

### **Brief Explanation**

Certain investigators have retired or left the university. Some projects were terminated earlier than originally anticipated. University has had several years of budget cuts, affecting ability to hire new or replacement faculty.

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

### 1. Evaluation Studies Planned

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

### **Evaluation Results**

{No Data Entered}

### **Key Items of Evaluation**

{No Data Entered}