

2010 University of Maine Research Annual Report of Accomplishments and Results

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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 11 Hatch and McIntire-Stennis projects went through the process in FY2010.

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 potato variety development and research on new ways to control potato pests and diseases..

Expenditure Summary

In our 2010 Plan of Work, the Maine Agricultural & Forest Experiment Station (MAFES) estimated 33.0 SYs for 2010; the actual number of SYs was 32.8 for FY2010. For FY2010 MAFES expended \$2,043,979 (Actual Formula Funds), \$3,313,358 (Actual Matching Funds), \$0 (Actual All Other Funds), for a total of \$5,357,337. Due to a change in the requirements for the AD419, this year no grant expenditures are included in the All Other Funds column in for our program areas. Instead we have included actual grants awarded as an output for each program area. MAFES researchers in these program areas received a total of \$7,764,574 in grants and contracts in university fiscal year 2010 (July 1, 2009, through June 30, 2010).

Planned Programs

This is the last year that we are submitting the Annual Report of Accomplishments and Results based on the program areas outlined in our original Plan of Work.

Natural Resources

In our 2010 plan of work, we estimated that there would be 9.0 SYs in this program area; the actual amount of SYs allocated for 2010 was 7.0. During FY2010, MAFES expended \$361,485 (Hatch), and \$685,259 (1862 Matching), and \$0 (1862 All Other), for a total of \$1,046,744 in this program area, and there were 14 research projects in this program area, falling under 12 knowledge areas. Some research in this program area supports NIFA's Sustainable Energy and Climate Change priorities and other goals and priorities of the Maine Agricultural & Forest Experiment Station.

MAFES research in this program area has resulted in a number of outputs for FY2010, including completed projects, two patents, peer-reviewed and other publications, presentations at professional

meetings, workshops, and other venues, vernal pool assessments and training sessions in Maine communities, and new techniques for culturing kleptoplastic sea slugs in the laboratory. Faculty working in this area brought in \$1,525,528 in extramural funding during university fiscal year 2010.

There were several outcomes in this program area during FY2010. To highlight a few: MAFES scientists have identified partial genes for plant nuclear-encoded photosynthesis proteins; MAFES fisheries biologists have monitored the effect of dam removals on resident fishes in Sedgeunkedunk Stream in Brewer, Maine, and have revealed unappreciated metapopulation connections among sturgeon in Maine, leading to a much broader conceptualization of conservation units and their critical habitat.

Plant Production

In our 2010 plan of work, we estimated that there would be 5.5 SYs in this program area; the actual amount of SYs allocated for 2010 was 4.5. During FY2010, MAFES expended \$291,111 (Hatch), and \$420,722 (1862 Matching), \$0 (1862 All Other) for a total of \$711,833 in this program area, and there were 12 research projects in this program area, falling under 14 knowledge areas. Research in this program area supports NIFA's Global Food Security and Hunger priority.

MAFES research in this program area has resulted in a number of outputs for FY2010, including completed projects, publications, videos, enterprise budgets, and presentations at professional meetings, workshops, and other venues. Faculty working in this area brought in \$1,455,778 in extramural funding during university fiscal year 2010.

There were several outcomes in this program area during FY2010. To highlight a few: MAFES researchers helped to identify new winter wheat varieties with promise for growing in northern New England; MAFES scientist, working with collaborators in China, have successfully regenerated two potential ornamental plants, *Symplocos tetragona* and *Zelkova schneideriana*, from stem cuttings and in vitro culture; MAFES agronomists completed a long-term study of crop rotation effects on soil quality and potato crop performance and found strong benefits to potato yield associated with two- and three-year rotations.

Plant Protection

In our 2010 plan of work, we estimated that there would be 4.9 SYs in this program area; the actual amount of SYs expended for 2010 was 5.0. During FY2010, MAFES expended \$410,655 (Hatch), and \$634,096 (1862 Matching), \$0 (1862 All Other) for a total of \$1,044,751 in this program area; there were 14 research projects in this program area, falling under 16 knowledge areas. Research in this program area supports NIFA's Global Food Security and Hunger priority.

MAFES research in this program area has resulted in a number of outputs for FY2010, including completed projects, mummy berry forecast systems, videos, research blogs, publications, and presentations at professional meetings, workshops, and other venues. Faculty working in this area brought \$1,520,471 in extramural funding during university fiscal year 2010.

There were several outcomes in this program area during FY2010. To highlight a few: in an effort to control invasive plants, MAFES scientists helped to train 32 people to identify invasive plants and use the VitalSigns system; MAFES entomologists continued to explore the use of natural enemies to control invasive fire ant species; MAFES research has shown that potato plants grown on organically amended soils are less favorable hosts to Colorado potato beetles compared to synthetically fertilized plants, thereby providing a tangible incentive for commercial potato growers to use organic soil amendments.

Animal Production & Protection

In our 2010 plan of work, we estimated that there would be 5.4 SYs in this program area; the actual amount of SYs allocated for 2010 was 6.4. During FY2010, MAFES expended \$287,423 (Hatch), \$532,741 (1862 Matching), and \$0 (1862 All Other) for a total of \$820,164 in this program area, and there were 13 research projects in this program area, falling under 9 knowledge areas. Research in this program area supports NIFA's Global Food Security and Hunger priority.

Research in this program area has resulted in a number of outputs for FY2010, including completed projects, publications, and presentations at professional meetings, workshops, and at other venues. A

patent for sea lice treatments has been submitted. Faculty working in this area brought in \$563,716 in extramural funding during university fiscal year 2010.

There were several outcomes in this program area during FY2010. To highlight a few: MAFES scientists have developed recommendations for improving soft-shell clam landings in eastern Maine; MAFES animal scientists have developed a new nested PCR to quickly determine the presence and type of Prototheca in a herd of dairy cattle; MAFES researchers have created human and fish pathogens that express a red fluorescent pigment, which allow real-time interactions between cells of the innate immune system and the bacterial pathogen to be viewed and recorded in live zebrafish; and in response to a blister worm infestation at an industry partner's oyster facility, MAFES researchers been investigating several treatments that will kill the worms while not harming the oysters.

Foods & Nutrition

In our 2010 plan of work, we estimated that there would be 4.4 SYs in this program area; the actual amount of SYs expended for 2010 was 2.1. During FY2010, MAFES expended \$120,727 (Hatch), and \$208,422 (1862 Matching), \$0 (1862 All Other) for a total of \$329,149 in this program area, and there were eight research projects in this program area, falling under 7 knowledge areas. Research in this program area supports NIFA's Global Food Security and Hunger, Childhood Obesity, and Food Safety priorities.

MAFES research in this program area has resulted in a number of outputs for FY2010, including publications, and presentations at professional meetings, workshops, and other venues. Faculty working in this area brought in \$777,885 in extramural funding during university fiscal year 2010.

There were several outcomes in this program area during FY2010. To highlight a few: MAFES food scientists continued to use their analytical expertise and resources to help a Maine elderberry producer launch an elderberry extract that is currently distributed through a major U.S. retailer; and MAFES research on the nutritional benefits of wild blueberries has been widely covered in local and national media.

Economics, Marketing, Policy and Community Development

In our 2010 plan of work, we estimated that there would be 5.0 SYs in this program area; the actual amount of SYs expended for 2010 was 5.8. During FY2010, MAFES expended \$439,658 (Hatch), \$535,774 (1862 Matching) and \$0 (1862 All Other) for a total of \$975,432 in this program area. There were 10 research projects in this program area, falling under 11 knowledge areas. Research in this program area supports NIFA's Global Food Security and Hunger, Climate Change, Food Safety priorities and other goals and priorities of the Maine Agricultural & Forest Experiment Station.

MAFES research in this program area has resulted in a number of outputs for FY2010, including completed projects, peer-reviewed and other publications, and presentations at professional meetings, workshops, and other venues. Food scientists also developed a simple, inexpensive, instrument-free gaseous ClO2 approach for disinfection of fresh produce. Faculty working in this area brought in \$1,921,196 in extramural funding during university fiscal year 2010.

There were several outcomes in this program area during FY2010. To highlight a few: To highlight a few: MAFES economists used stated-preference data to estimate consumer willingness to pay for food-safety vaccines; Maine voters relied upon MAFES research on the impacts of the proposed casino.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	33.0	0.0
Actual	0.0	0.0	32.8	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 all MAFES projects, regardless of funding source. A total of 11 Hatch and McIntire-Stennis projects went through the process in FY2010.

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.

The Maine Agricultural and Forest Experiment Station and College of Natural Sciences, Forestry, and Agriculture encouraged stakeholder input by hosting formal meetings with advisory groups including the Board of Agriculture (thrice annually), 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 met independently with the Maine Potato Board to discuss long-term needs and opportunities.

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 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. This council has representatives from more than 20 agricultural associations in Maine and the Maine Department of Agriculture, Food and Rural Resources, who are joined by 13 associate members representing other agricultural associations and agencies. These meetings provide MAFES administration with valuable 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 have extensive interaction with stakeholder groups and individuals in both formal and informal settings, which encourages stakeholder participation.

At our research facilities, scientists and staff hosted field days for apples, small fruits, and vegetables, potatoes, and wild blueberries and other crops, which allow 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, MAFES and MAC need to update long-range plans on an on-going basis.

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.

Variety development and pest and disease research and management are high-priority areas for the Maine potato industry and are facing new challenges.

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.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	2110853	0

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	2043979	0
Actual Matching	0	0	3313358	0
Actual All Other	0	0	0	0
Total Actual Expended	0	0	5357337	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	226311	0

V. Planned Program Table of Content

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

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Natural Resources

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			1%	
111	Conservation and Efficient Use of Water			4%	
112	Watershed Protection and Management			4%	
123	Management and Sustainability of Forest Resources			6%	
133	Pollution Prevention and Mitigation			6%	
134	Outdoor Recreation			3%	
135	Aquatic and Terrestrial Wildlife			47%	
136	Conservation of Biological Diversity			2%	
201	Plant Genome, Genetics, and Genetic Mechanisms			5%	
206	Basic Plant Biology			9%	
402	Engineering Systems and Equipment			9%	
608	Community Resource Planning and Development			4%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	9.0	0.0
Actual	0.0	0.0	7.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	361485	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	685259	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

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

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2010

Actual: 2

Patents listed

Xinfeng Xie and Barry Goodell. 2010. Preparation of Algal Cells for Bio-Oil Extraction. Provisional application. Serial No: 61/381590.

Xinfeng Xie and Barry Goodell. 2010. Highly Ordered Mesoporous Carbon from Lignocellulosic Materials. Provisional application. Serial No: 61/381562.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	29	29

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of other types of publications

Year	Actual
2010	15

Output #2

Output Measure

- # of papers presented at professional meetings

Year	Actual
2010	70

Output #3

Output Measure

- # of research projects completed

Year	Actual
2010	3

Output #4

Output Measure

- # of computer program to simulate borehole flow in a well intersected by discrete zones with different far-field hydraulic heads and transmissivities

Year	Actual
2010	1

Output #5

Output Measure

- New techniques for culturing kleptoplastic sea slugs in the laboratory

Year	Actual
2010	0

Output #6

Output Measure

- # of vernal pool assessment protocol for loggers

Year	Actual
2010	1

Output #7

Output Measure

- # of Maine towns for which MAFES scientists conducted vernal pool assessments in 2010, assessing hundreds of vernal pools

Year	Actual
2010	5

Output #8

Output Measure

- # of training and informational workshops in 8 Maine towns in 2010--vernal pool training workshops to land trusts, tax assessors, and foresters. Trainings are both indoor and field based.

Year	Actual
2010	14

Output #9

Output Measure

- Educational materials on vernal pools for the US Army Corps of Engineers available on their website

Year	Actual
2010	0

Output #10

Output Measure

- Genomic and transcriptomic sequence data from Elysia chlorotica

Year	Actual
2010	0

Output #11

Output Measure

- Amount of extramural funding awarded to faculty working in this program area during university fiscal year 2010

Year	Actual
2010	1525528

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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

18	Number of people developing a better understanding of population boundaries of harbor seals in the western North Atlantic
19	Number of management agencies using information on assessment of population abundance, movement and habitat of shortnose and Atlantic sturgeon in the Penobscot River System
20	Number of NGOs using information on assessment of population abundance, movement and habitat of shortnose and Atlantic sturgeon in the Penobscot River System
21	Increased understanding of how migratory bird populations are regulated throughout the annual cycle
22	Protection of key migratory flyways and associated stopover sites along the Maine coastal and offshore islands

Outcome #1

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
2010	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Domestic wells typically penetrate into the bedrock and extract ground water from fractures. These wells are threatened by a variety of human activities. Once contaminated, a detailed understanding the ground-water hydraulics of fractured bedrock aquifers is required to predict ground-water flow direction and identify potential receptors. This project will focus on several Maine DOT facilities where deicing salts appear to have contaminated the fractured bedrock aquifer. Borehole geophysics will be used to characterize the ground-water flow and distribution of road deicing salt within boreholes at these sites. Computer programs will be used to simulate the ground-water flow and solute transport within a borehole and within a fracture network and compared to the hydrologic and chemical data to create conceptualized ground-water flow and solute transport computer models of these sites.

What has been done

MAFES scientists developed a computer program to simulate borehole flow in a well intersected by fractures with different far-field hydraulic heads and transmissivities.

Results

Results from the Jonesboro, Maine, study area, the location of a deicing salt release, illustrate the extreme heterogeneity in fractured bedrock systems.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Transmissivity and far-field hydraulic head for individual fractures can be quantified by calibrating a model of a borehole to measured flow profiles by varying these two hydraulic properties.

What has been done

To verify the borehole flow model is working properly, MAFES scientists analyzed published borehole flow data using this model and compared the results were to published estimates of fracture transmissivity and far-field hydraulic head. The scientists interfaced the calibration process, previously completed through a trial-and-error process, with optimization routines that automate this process.

Results

Initial efforts to optimize borehole flow models required computing times ranging from about 12 hours to several days. Recently, new nonlinear optimization routines have been utilized that are much more efficient, reducing the time required to optimize a borehole flow model to about 2

hours.

4. Associated Knowledge Areas

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

Outcome #3

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	200	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Preservation of adaptive variation within and among populations is an important element of many conservation and management programs. However, little is generally known about adaptive diversity in many species of practical concern or the best approaches to maintain such diversity. Indeed, the implications of most conservation and management schemes for adaptive variation are largely untested. This work characterizes potential adaptive variation in Maine salmonids and employs simulation and biological model systems to understand management implications for preserving adaptive variation in Maine fishes and other species in general.

What has been done

MAFES fishery biologists have examined the adaptive trait variation in Maine fishes of conservation or recreational concern, and on the use of model systems for exploring evolutionary implications of management and conservation strategies.

Results

In 2009 the scientists published a paper showing that harvest by humans drives faster rates of evolution than found in nature or other contexts involving human disturbance. This paper has already been cited 27 times, hinting at the impact it is currently having on the minds developing harvest policy worldwide. Recent findings from their guppy model system suggest that genetic

diversity within species can have profound effects on population and ecosystem function. In total, this theoretical and model work, particularly the eco-evolutionary frameworks that they have developed, have begun to gather significant attention within the applied fields of conservation, resource management and beyond. Indeed, in the last year the scientists have been invited to present their insights in keynote talks, and summits in the U.S. and abroad.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #4

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 #5

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	20	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Rapid near real-time capabilities using in-process-line sensors are needed to replace slower off-line wet chemistry methods. Near-infrared spectroscopy (NIRS) offers one option for consideration.

What has been done

MAFES researchers have developed NIR techniques to successfully 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.

Results

Knowing the concentration of these components is fundamental to in-line decision making and full use of the extracts.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment

Outcome #6

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #7

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

Not Reporting on this Outcome Measure

Outcome #8

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
2010	1	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Maine harbors the only wild Atlantic salmon and is the last stronghold for wild brook trout in the U.S. Both fish are important to anglers; securing healthy, fishable populations is a top management goal and sound economic policy. Sportfishing in Maine provides \$250 million in economic output, \$18 million in tax revenue, and 3,200 jobs; 279,000 people hold Maine fishing licenses. The persistence of these, and other, fishes is threatened by many factors, including habitat alteration and competition from exotic species, such as small-mouth bass. While the spread of exotic small-mouth bass throughout Maine waters is alarming, this fish is popular with

What has been done

MAFES scientists have designed a project to provide fisheries managers with the information required to improve native fisheries while balancing conflicting objectives of varied resource users.

Results

To answer questions about the species' coexistence, the researchers have learned about the interactions between exotic small-mouth bass and native Atlantic salmon in nursery streams. They've found that small-mouth bass compete for habitat with Atlantic salmon, but only at certain life stages and seasons. This competition, however, is likely to occur during the summer when Atlantic salmon face stress from limited habitat and high temperatures already. State fisheries managers can use these results in planning stocking, regulations, habitat improvement, and mitigation measures.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #9

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #11

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #12

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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
135	Aquatic and Terrestrial Wildlife

Outcome #13

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	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
135	Aquatic and Terrestrial Wildlife

Outcome #14

1. Outcome Measures

Increase in the distribution and abundance of migratory fish in Maine

Not Reporting on this Outcome Measure

Outcome #15

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Clayton's copper butterfly is listed as endangered in Maine and is known from only 13 sites globally (in Maine and New Brunswick, Canada). The population size has only been estimated at one of these sites in Maine. The taxonomic distinctiveness of Clayton's copper butterfly from the nominate species, Dorcas copper, is controversial which affects its status at the global level.

What has been done

MAFES scientists are working to clarify its taxonomic status, develop a statewide monitoring plan and baseline population estimate, determine the population structure of the butterfly and its host plant in Maine, and analyze the wetland habitat dynamics.

Results

Their 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 two important Nature Conservancy sites, one of which is also crucial for a federally endangered species of orchid.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #16

1. Outcome Measures

Identifying partial genes for plant nuclear-encoded photosynthesis proteins

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Photosynthesis is the primary determinant of crop productivity. It is the single process on earth that converts sunlight into biomass, sequesters atmospheric CO₂ into carbohydrates, and liberates O₂. Photosynthesis and the formation of food, fiber, and biomass are dramatically limited by environmental, biochemical, and genetic constraints. Alleviation of some or all of these constraints could lead to substantial increases in plant productivity. As part of Multistate Project NC1168: Regulation of photosynthetic processes, MAFES scientists are working with highly productive photosynthesis investigators from across the country in an integrated effort to broaden our understanding of this critically important process.

What has been done

The scientists have been working to identify regulatory pathways by which plastid biogenesis and photosynthetic functions are modulated and studying direct signaling pathways and photosynthetic protein transfer between chloroplasts and the nucleus.

Results

: MAFES scientists have recently identified two partial genes for plant nuclear-encoded photosynthesis proteins, the photosystem II Mn-stabilizing protein (psbO) and the Calvin Cycle enzyme phosphoribulokinase (prk), in the sea slug's DNA. Further identification of DNA elements that have been horizontally transferred to the sea slug is one component to understanding the host cell nuclear contribution to maintaining the engulfed plastids. Another key component is to identify and characterize the chloroplast proteome in the sea slug over the entire life-cycle to better understand the role of the nucleus in chloroplast gene expression and the stability of chloroplast proteins. Kleptoplastic sea slugs potentially have a direct bearing on human health, through their production of anti-cancer/tumor compounds, as models for immuno-therapy and drug delivery, and for their glaring absence of an immune-rejection response. All of these properties may be related to additional symbiotic associations the sea slug forms with various

bacterial species that we have identified through next generation sequencing.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology

Outcome #17

1. Outcome Measures

Effect of dam removals on fish populations

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Maine harbors the only wild Atlantic salmon and is the last stronghold for wild brook trout in the U.S. Both fish are important to anglers; securing healthy, fishable populations is a top management goal and sound economic policy. Sportfishing in Maine provides \$250 million in economic output, \$18 million in tax revenue, and 3,200 jobs; 279,000 people hold Maine fishing licenses. Maine citizens derive sociological and aesthetic benefits from healthy, intact waters that support wild Atlantic salmon, brook trout, and other native species. Historically, Atlantic salmon and brook trout have been harmed by forest clearing and dam-building, but now there is interest in reforestation and dam removal.

What has been done

MAFES researchers have been monitoring the effect of dam removals on resident fishes in Sedgeunkedunk Stream in Brewer, Maine.

Results

Their early results show distinct patterns in stream fish metrics over time and space due to the presence of a dam, and immediately after dam removal they saw drastic changes, including sea lamprey, juvenile Atlantic salmon, and alewife moving upstream into previously inaccessible habitat. The consistency in metrics over time and space, coupled with drastic changes after dam

removal, suggest that this study will help scientists predict how other streams will respond to impending dam removal. Fisheries managers can use this information in future planning. This project's partnership with federal, state, and local governments and the public provides a model of how strong community involvement can drive river restoration.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #18

1. Outcome Measures

Number of people developing a better understanding of population boundaries of harbor seals in the western North Atlantic

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	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 #19

1. Outcome Measures

Number of management agencies using information on assessment of population abundance, movement and habitat of shortnose and Atlantic sturgeon in the Penobscot River System

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

MAFES research on the abundance and movement patterns of shortnose and Atlantic sturgeon has been extensively used in guiding recent federal permitting and monitoring in association with development and remediation activities in the Penobscot River corridor. The work has revealed unappreciated metapopulation connections among sturgeon in Maine, leading to a much broader conceptualization of conservation units and their critical habitat

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #20

1. Outcome Measures

Number of NGOs using information on assessment of population abundance, movement and habitat of shortnose and Atlantic sturgeon in the Penobscot River System

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

oMAFES research on the abundance and movement patterns of shortnose and Atlantic sturgeon has been extensively used in guiding recent federal permitting and monitoring in association with development and remediation activities in the Penobscot River corridor. The work has revealed unappreciated metapopulation connections among sturgeon in Maine, leading to a much broader conceptualization of conservation units and their critical habitat.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #21

1. Outcome Measures

Increased understanding of how migratory bird populations are regulated throughout the annual cycle

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
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2010 {No Data Entered} 0

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 for many species and difficult to quantify. Physiologic indicators of individual condition are needed to understand how Maine's wildlife are responding to events that occur before and after they arrive in Maine.

What has been done

MAFES researchers have focused on behavioral and physiological differences in migratory strategies of a long-distance migrant, the Blackpoll Warbler, and a facultative short-distance migrant, the Yellow-rumped Warbler. The scientists examined the behavioral and endocrine aspects of migration physiology and how variation in these processes may reflect different migration strategies.

Results

A significant amount of information collected during this project has been incorporated into the species account for the Blackpoll and Yellow-rumped warblers in the Cornell Lab of Ornithology/American Ornithologists' Union sponsored Birds of North America online (<http://bna.birds.cornell.edu/bna/>) resource for life histories of birds and "Birdlife of the Churchill Region: Status, History, Biology" by JR Jehl, Jr., 2004. Trafford Publ. Co.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #22

1. Outcome Measures

Protection of key migratory flyways and associated stopover sites along the Maine coastal and offshore islands

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Millions of migratory bird species pass through Maine on their journey between their breeding and wintering grounds. While these birds that travel well beyond the Gulf of Maine are good at what they do, it might not take much more than one thing, such as loss of critical migratory habitat in addition to loss of wintering and breeding areas, to push them over a threshold at which they can no longer sustain their populations. In Maine, they face potential hazards during their migration from land development along the coastline and the development of coastal or near-shore areas for sources of wind energy.

What has been done

Faculty and student researchers from UMaine are part of the Northeast Regional Migration Monitoring Network, a cooperative of Canadian and U.S. nonprofit organizations, government agencies and university researchers. The Network has spent the last two years trying to determine how migrating species use the Gulf of Maine's complex network of islands and coastal areas. Using a combination of decades-old monitoring techniques and newer technologies, Network researchers are examining migratory movements made by both large groups of birds and individuals.

Results

The researchers now 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. 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. 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. The five most abundant songbird species caught on Metinic, Seal and Petit Manan islands were Myrtle Warbler, Savannah Sparrow, Common Yellowthroat, White-throated Sparrow and Red-eyed Vireo.

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

{No Data Entered}

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

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

Plant Production

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources			8%	
102	Soil, Plant, Water, Nutrient Relationships			36%	
111	Conservation and Efficient Use of Water			4%	
201	Plant Genome, Genetics, and Genetic Mechanisms			3%	
202	Plant Genetic Resources			5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			10%	
204	Plant Product Quality and Utility (Preharvest)			3%	
205	Plant Management Systems			14%	
206	Basic Plant Biology			7%	
211	Insects, Mites, and Other Arthropods Affecting Plants			4%	
212	Pathogens and Nematodes Affecting Plants			2%	
213	Weeds Affecting Plants			2%	
215	Biological Control of Pests Affecting Plants			1%	
503	Quality Maintenance in Storing and Marketing Food Products			1%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	5.5	0.0
Actual	0.0	0.0	4.5	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	291111	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	420722	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**

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**

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Year: 2010

Actual: 0

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

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	12	25

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of research projects completed

Year	Actual
2010	3

Output #2

Output Measure

- # of papers presented at professional meetings

Year	Actual
2010	47

Output #3

Output Measure

- # of other types of publications

Year	Actual
2010	19

Output #4

Output Measure

- MAFES scientists lead a 2-day trip to Quebec for 26 farmers, millers, bakers and researchers to tour Quebec's highly successful local bread wheat system.

Year	Actual
2010	1

Output #5

Output Measure

- # of videos produced: "Local Bread Wheat in Quebec" and "Weed Control in Organic Cereals." Both are posted on our newly created project website, <http://sites.google.com/site/localbreadwheatproject/>, as well as on the Northern Grain Growers Association website, which this project supports, <http://northerngraingrowers.org/>.

Year	Actual
2010	2

Output #6

Output Measure

- # of interactive enterprise budgets that allow farmers to evaluate the economics of adding a bread wheat enterprise to their operation. Interactive version and posted on website; hard copies were distributed field days, workshops, and grower meetings.

Year	Actual
2010	1

Output #7

Output Measure

- # of surveys was sent to 343 wild blueberry growers in the state of Maine asking questions management practices, pesticide use, priorities, influences in decision-making, and beliefs about pesticide safety

Year	Actual
2010	1

Output #8

Output Measure

- Amount of extramural funding awarded to faculty working in this program area during university fiscal year 2010

Year	Actual
2010	1455778

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	Increase in profitability for Maine apple industry from a quicker return on investment and reduction in catastrophic tree losses (\$)
3	# of commercial-scale tests of new high-yielding, high-quality, and/or pest-resistant potato clones tested in Maine
4	# of Maine seed growers adopting new high-yielding, high-quality, and/or pest-resistant clones from the Maine Potato Breeding Program or other programs represented in our commercial trial program (as indicated by entry in seed certification)
5	Decrease in percentage of lowbush blueberry leaf tissue samples with nitrogen and phosphorus deficiencies
6	Number of facilities propagating lowbush blueberry by tissue culture using information from this research
7	# of Maine lowbush blueberry growers learning about benefits of leaf sampling techniques to aid in fertility management decisions
8	Percentage of Maine lowbush blueberry growers surveyed who are changing their fertilization practices due to information provided by the fertility research program
9	# of high-quality and/or pest-resistant potato clones from the Maine Potato Breeding Program made available to other states for evaluation under diverse environmental conditions
10	# of new high-yielding, high-quality, and/or pest-resistant potato clones named and released by the Maine Potato Breeding Program
11	Percentage of Maine potato growers informed about promising new potato clones from the Maine Potato Breeding Program and other eastern programs
12	# of people improving their knowledge of the potential benefits of composting
13	Number of people surveyed using composts as a soil amendment to reduce organic waste volume and improve soil quality
14	# of Maine and New England vegetable growers learning about regionally adapted vegetable varieties
15	# of Maine vegetable growers learning about alternative crops and appropriate cultural management techniques for hoop house production
16	# of Maine vegetable growers learning about fall beds and the hybrid mulching system
17	# of Maine vegetable growers practicing crop rotation in hoop houses by growing alternative crops

18	# of Maine vegetable growers using fall made beds or hybrid mulching
19	Percentage of Maine vegetable growers that have improved management of their hoop houses
20	Reduced pesticide use and/or improved marketable yields on acres planted to new pest-resistant potato cultivars in Maine
21	Percentage of Maine potato producers improving their knowledge of the benefits of using organic amendments in their cropping systems
22	Percentage of Maine potato growers adding organic amendments to improve soil quality
23	Percentage of Maine potato growers decreasing their use of synthetic purchased fertilizer due to use of organic nutrients
24	Number of Maine potato growers increasing their understanding of plant productivity, nutrient cycling and pest ecology in carbon-enriched potato cropping systems
25	Number of Maine organic vegetable crop growers increasing their understanding of how biologically based soil amendments can enhance soil quality and fertility in Maine
26	Percentage of farmers taking part in a study trip to Quebec who have started harvesting their wheat at a higher grain moisture content to protect grain quality
27	Number of new winter wheat varieties identified as showing promise for growing in northern New England
28	Number of potential ornamental plants that have been successfully regenerated from stem cutting and in vitro culture
29	Improved potato yields
30	# of acres in northern Maine potato production systems that were treated with wood ash over the past two years with lime and fertilizer savings amounting to \$30 to \$60 per acre
31	Improved fertilization recommendations for potato growers
32	Number of late blight resistant UMaine clones that are in commercial evaluation

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

Year	Quantitative Target	Actual
2010	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
101	Appraisal of Soil Resources

Outcome #2

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #3

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
2010	10	16

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

ME coordinated 16 commercial-scale trials representing 12 new potato varieties (4 chippers, 2 russets, 4 reds, 1 late blight resistant round white, and 1 fresh market yellow fleshed) and 63 acres during 2010.

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

Outcome #4

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

Year	Quantitative Target	Actual
2010	5	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Eastern potato production represents hundreds of farms and more than \$460 million cash farm receipts; therefore, the impact of a successful new potato variety can mean many millions of dollars to the industry. Consumers also benefit from the high quality, local food production resulting from new potato variety adoption. Disease resistant varieties generated by this project have the potential to greatly reduce growers' losses to devastating diseases such as pink rot and/or late blight.

What has been done

The eastern potato breeding and selection effort produces new varieties and evaluates their potential to serve fresh, processing, and specialty markets in the East.

Results

Red Maria (NY129) was released in 2010 and the release of two new chipping varieties, Lamoka (NY139) and Waneta (NY138), is anticipated in 2011. Demand for seed of NY138 and NY139 has exceeded supply. Recent eastern releases since 2002 (e.g. Marcy, Monticello, Harley Blackwell, Red Maria, Lehigh, and Peter Wilcox) were grown on 452 seed acres during 2010 with a seed value of \$1,200,000. The resulting seed crop has the potential to plant 4500 acres in 2011 with a ware value conservatively estimated at \$9M.

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

Outcome #5

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #7

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
2010	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
102	Soil, Plant, Water, Nutrient Relationships
206	Basic Plant Biology

Outcome #8

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

Not Reporting on this Outcome Measure

Outcome #9

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

Year	Quantitative Target	Actual
2010	10	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

There were six advanced UMaine clones entered into commercial evaluations during 2010. AF2291-10 is an early blight and scab resistant clone with good chipping quality. AF2574-1 is a fresh market clone with good yields and late blight resistance. AF0338-17 is a round-white that is widely adapted to eastern growing conditions and can chip from the field. AF3001-6, AF3362-1, and AF3317-15 are being evaluated as dual-purpose clones for french fry processing and fresh market. The latter has very good late blight, scab, and pink rot resistance.

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

Outcome #10

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #11

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	50	50

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

Outcome #12

1. Outcome Measures

of people improving their knowledge of the potential benefits of composting

Not Reporting on this Outcome Measure

Outcome #13

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #14

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
2010	1000	1800

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 #15

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
2010	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 #16

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
2010	100	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 #17

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #18

1. Outcome Measures

of Maine vegetable growers using fall made beds or hybrid mulching

Not Reporting on this Outcome Measure

Outcome #19

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #20

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #21

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #22

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #23

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #24

1. Outcome Measures

Number of Maine potato growers increasing their understanding of plant productivity, nutrient cycling and pest ecology in carbon-enriched potato cropping systems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	140

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
212	Pathogens and Nematodes Affecting Plants

Outcome #25

1. Outcome Measures

Number of Maine organic vegetable crop growers increasing their understanding of how biologically based soil amendments can enhance soil quality and fertility in Maine

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	150

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

Outcome #26

1. Outcome Measures

Percentage of farmers taking part in a study trip to Quebec who have started harvesting their wheat at a higher grain moisture content to protect grain quality

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	50

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 #27

1. Outcome Measures

Number of new winter wheat varieties identified as showing promise for growing in northern New England

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

Several farmers planted one new variety based on the yield and quality data that was made available to them in late August. The new variety had exceptional yield and quality; bake tests performed by local bakers confirmed field and lab results.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #28

1. Outcome Measures

Number of potential ornamental plants that have been successfully regenerated from stem cutting and in vitro culture

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

In collaboration with China, two potential ornamental plants, *Symplocos tetragona* and *Zelkova schneideriana*, have been successfully regenerated from stem cuttings and in vitro culture. *Symplocos tetragona* could be propagated by semi-hardwood cuttings and the rooting percentage and quality (by rooting ball volume) had been significantly increased by rotting hormones. The highest rooting rate (100%) was obtained from cuttings treated with powery hormone Hormodin #3. To produce *Zelkova schneideriana*, leaf explants were cultured on Wood Plant Medium (WPM), Murashige and Skoog (MS), 1/2MS, or B5 media with various hormones. WPM was the most effective medium for callus induction, which regenerated plantlets.

4. Associated Knowledge Areas

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

Outcome #29

1. Outcome Measures

Improved potato yields

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{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. Fertilizer and pesticide input costs have increased by approximately twofold over the past few 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 completed a long-term study of crop rotation effects on soil quality and potato crop performance during 2010. Continuous potatoes was compared to three different two-year rotations and a three-year rotation containing a mixed clover and timothy green manure.

Results

They found US1 yields of Superior potatoes were equal among the two- and three-year rotations, averaging 28.4 t per ha, far greater than the 9.0 t per ha yield in the continuous potato treatment. Late-season crop vigor also improved as rotation length increased, and early-dying incidence and severity decreased as rotation length increased. Over the full project, the three-year rotation was the highest yielding followed by a two-year rotation supplemented with occasional applications of compost and manure. The researchers found that consistent use of a clover rotation crops can reduce N fertilizer costs for growers, while maintaining soil cover and providing high yields and good tuber quality. A 100 lbs/A reduction in N needs can reduce the N fertilizer costs by \$40/A.

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 #30

1. Outcome Measures

of acres in northern Maine potato production systems that were treated with wood ash over the past two years with lime and fertilizer savings amounting to \$30 to \$60 per acre

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	8000

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
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 #31

1. Outcome Measures

Improved fertilization recommendations for potato growers

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

MAFES scientists are continuing to use potato research plots to provide better tools for predicting N and other nutrient needs through soil testing. Virtually all potato soils in Maine are routinely soil tested for nutrient availability, and the fertilization recommendations provided to our growers are based, in part, on MAFES research.

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 #32

1. Outcome Measures

Number of late blight resistant UMaine clones that are in commercial evaluation

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

Two late blight resistant clones, AF2574-1 (fresh market, white) and AF3317-15 (russet, french fry processing), are in initial stages of commercial evaluation. If adopted they could reduce the number of fungicide applications needed to grow a potato crop and/or reduce the risk of late blight infection and spread.

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

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

{No Data Entered}

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

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

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%	
202	Plant Genetic Resources			7%	
204	Plant Product Quality and Utility (Preharvest)			1%	
205	Plant Management Systems			14%	
206	Basic Plant Biology			1%	
211	Insects, Mites, and Other Arthropods Affecting Plants			8%	
212	Pathogens and Nematodes Affecting Plants			16%	
213	Weeds Affecting Plants			22%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants			1%	
215	Biological Control of Pests Affecting Plants			2%	
216	Integrated Pest Management Systems			8%	
311	Animal Diseases			7%	
605	Natural Resource and Environmental Economics			1%	
701	Nutrient Composition of Food			1%	
721	Insects and Other Pests Affecting Humans			7%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	4.9	0.0
Actual	0.0	0.0	5.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	410655	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	630298	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

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

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	18	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of other types of publications

Year	Actual
2010	14

Output #2

Output Measure

- # of papers presented at professional meetings

Year	Actual
2010	41

Output #3

Output Measure

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

Year	Actual
2010	2

Output #4

Output Measure

- # of mummy berry forecast systems (MBFS)

Year	Actual
2010	1

Output #5

Output Measure

- # of videos produced on new tools for weed control on organic farms: (1) Prologue: Weedmaster...Why?; (2) Weedmaster Field Trial: Peacemeal Farm; (3) Weedmaster Field Trial: Fisher Farm; and (4) Weedmaster Field Trial: Fail Better Farm.

Year	Actual
2010	4

Output #6

Output Measure

- # of research blogs (see gallandt.wordpress.com),

Year	Actual
2010	1

Output #7

Output Measure

- Maine Invasive Species Network was established following a one-day workshop involving professionals from four universities, several state and federal government agencies, one national park and two non-government agencies.

Year	Actual
2010	0

Output #8

Output Measure

- A survey of the landscape and nursery industry was conducted to identify industry views on invasive plant issues, attitudes towards potential regulation, and to estimate the potential economic costs of banning the sale of specific invasive plant species in Maine.

Year	Actual
2010	1

Output #9

Output Measure

- Website to facilitate future Maine Invasive Species Network projects
<http://umaine.edu/invasivespecies>

Year	Actual
2010	1

Output #10

Output Measure

- Amount of extramural funding awarded to faculty working in this program area during university fiscal year 2010

Year	Actual
2010	1520471

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	Average density of germinable weed seedbank found by Maine growers adopting ecologically based weed management practices (# of germinable seeds per square meter, 10 cm deep). Weed populations surviving cultivation will not reduce crop yield or quality and
3	Wild blueberry growers in Maine will be able to improve production by proper management of weed and disease pests
4	Wild blueberry growers in Maine will be able to properly identify and respond appropriately to weeds and diseases
5	Wild blueberry growers will make better management decisions on fertilizer and weed control
6	Increase in number of organic potato growers using biocontrol and mutualistic microorganisms to improve disease management, enhance crop yields, and increase soil fertility
7	Number of wild blueberry acres in Maine being treated with control measures for leaf drop diseases
8	Decrease in use of fungicides to control mummy berry disease of wild blueberry in Maine
9	Number of Maine blueberry growers increasing their understanding of mummy berry forecast system (MBFS) to control mummy berry blight in lowbush
10	Number of Maine blueberry growers increasing their understanding of the efficacy of lower risk fungicides to control mummy berry blight
11	Better understanding of the control of late blight in potatoes
12	Maine blueberry growers will increase their awareness of Valdensinia leaf-spot disease
13	Increase in use of commercial bumble bees as pollinators for lowbush blueberry
14	Reduced reliance on insecticides for controlling Colorado potato beetle in Maine potato fields
15	Number of people improving their understanding about how to manage weed seed rain
16	Improved methods for controlling the invasive European fire ant
17	Number of people in Maine trained to identify invasive plants, conduct a field siting and publish their sitings in the VitalSigns system

18	Number of possible biological control agents identified for control of Japanese barberry
19	Number of participants who completed the full-day training session of the Invasive Plant Atlas of New England

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	25	25

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
216	Integrated Pest Management Systems

Outcome #2

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

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #5

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
2010	100	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. Furthermore, hexazinone, a commonly used herbicide in wild blueberry production, is a known and pervasive groundwater contaminant, due to its high water solubility.

What has been done

MAFES scientists conducted a study to assess the effects of pre-emergence herbicides on wild blueberry cover, phytotoxicity and broadleaf and grass weed cover in spring/summer 2010 using an RCBD design with 6 replications: a check, hexazinone, hexazinone + surfactant, indaziflam, terbacil WP, terbacil WDG, terbacil WDG + mesotrione, pendimethalin and rimsulfuron. Plots were evaluated at one, two, four and eight weeks post-treatment and were analyzed using a nonparametric median two-sample exact test $P < 0.05$. Treatments were compared individually to the check, to the standard hexazinone and to each other where relevant.

Results

This study illustrated there are several viable options to Velpar, both currently registered and in development, that may be used in rotation to effectively control weeds without significant injury to wild blueberries.

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 #6

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #9

1. Outcome Measures

Number of Maine blueberry growers increasing their understanding of mummy berry forecast system (MBFS) to control mummy berry blight in lowbush

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	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
216	Integrated Pest Management Systems

Outcome #10

1. Outcome Measures

Number of Maine blueberry growers increasing their understanding of the efficacy of lower risk fungicides to control mummy berry blight

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #11

1. Outcome Measures

Better understanding of the control of late blight in potatoes

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The combination of the bottleneck requirement of winter survival in diseased potatoes, stricter enforcement of cull pile disposal, and pathogen strains virulent enough to limit viability of fall-infected seed, late blight has the potential for eradication in most U.S. and Canadian growing

regions. Essential to this is the prevention of disease spread in seed prior to planting.

What has been done

MAFES researchers evaluated fungicides for their potential as additives to potato seed treatments, which lack materials effective against late blight. Seven oomycete-specific fungicides were compared with the two fungicides currently labeled for seed treatment, mancozeb and cymoxanil. The fungicides were evaluated for their ability to suppress superficial mycelium and spore production by infected seed pieces, to prevent infection by spores, to prevent infection by mycelium, to not stimulate bacterial development, and to be used at amounts that were economic and not affect shoot emergence.

Results

The scientists found that when applied to seed at 1/10 the amount labeled for the equivalent foliage produced, Forum, Presidio, Reason, Revus Top and Zampro all provided good to excellent suppression of mycelial growth, as did mancozeb. Previcure Flex and cymoxanil did not. All of the materials tested, including commercial mancozeb/bark formulations, prevented infection by spores. However, direct infection by tuber-to-tuber contact was much less sensitive. The researchers believe that recent trends toward lack of adequate seed treatments can be reversed by inclusion of small, inexpensive amounts of systemic oomycete-specific fungicides in or with standard seed protectants.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

Outcome #12

1. Outcome Measures

Maine blueberry growers will increase their awareness of Valdensinia leaf-spot disease

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Valdensinia leaf spot (caused by *Valdensinia heterodoxa*) causes early leaf drop in lowbush blueberries and in pruned fields can cause complete leaf drop so that no flower buds are produced by infected stems. By June 2009, *Valdensinia* leaf spot had caused complete defoliation in approximately 40 crop and prune fields in Nova Scotia, and had been found in Quebec and New Brunswick fields. By July 15, 2009, this fungus had been found in Maine wild blueberry fields and garden plantings. This emerging plant disease is new to Maine, so Maine wild blueberry producers need resources and training to spot and deal with the disease.

What has been done

MAFES scientists held grower meetings in 2010 to educate blueberry growers about the differences between *Septoria*, "false *Valdensinia*," and *Valdensinia* leaf spots and their control measures.

Results

There has been an increase in the awareness and knowledge of *Valdensinia* leaf spot throughout the blueberry growing areas of the state. Due to the identification of *Valdensinia* leaf spot, growers became more aware of the disease and its effects on lowbush blueberry. Researchers and some blueberry growers are enacting methods to limit the spread of this disease by screening for contamination of equipment and personnel before moving between fields.

4. Associated Knowledge Areas

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

Outcome #13

1. Outcome Measures

Increase in use of commercial bumble bees as pollinators for lowbush blueberry

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Pollination is one of the largest production costs in lowbush blueberry. Maine blueberry growers currently rent more than 75,000 honey bee colonies each year. The recommended honey bee stocking density for lowbush blueberry is 4 hives/acre, although the numbers of colonies rented suggest an actual stocking density of 2.3 hives/acre, but some growers in Washington County, ME, deploy 8 to 10 hives/acre. Given the problems facing honey bees, many blueberry growers are concerned that the current supply of colonies may not continue.

What has been done

To address these concerns, MAFES entomologists are developing and refining recommendations for managing commercial bumble bees as blueberry pollinators.

Results

: Although the project is in its early stages, the researchers have found that Maine lowbush blueberry growers are already increasing the number of commercial bumble bees hives that they use each year. Based on a survey, the scientists found that organic growers rely upon bumble bees the most (31%), comparable to their investment in honey bees (38%). Conventional and no-spray growers use bumble bees at a low rate (8% and 0%, respectively) compared to a relatively high investment in honey bees (75% and 50%, respectively). Twenty-seven percent of IPM growers invest in bumble bees whereas 88% of them rent honey bees.

4. Associated Knowledge Areas

KA Code	Knowledge Area
136	Conservation of Biological Diversity
205	Plant Management Systems

Outcome #14

1. Outcome Measures

Reduced reliance on insecticides for controlling Colorado potato beetle in Maine potato fields

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Colorado potato beetle is an important and costly pest of potatoes. Potato growers need new, environmentally friendly methods to limit damage from these insects.

What has been done

MAFES entomologists are attempting to determine individual- and population-level processes responsible for the decrease in the Colorado potato beetle populations on potato plants grown in manure-amended soils.

Results

Their results provide a tangible incentive for commercial potato growers to use organic soil amendments. Potato plants grown on organically amended soils are less favorable hosts to Colorado potato beetles compared to synthetically fertilized plants, as evidenced by slower beetle development, and, in some cases, increased larval mortality. Adult beetles do not avoid such plants; indeed their recruitment and oviposition might be higher on amended plants early in the season because such plants emerge earlier and have a more vigorous stand. This puts subsequently hatching larvae at a disadvantage, however. As a result, larval populations are commonly lower on amended plots later in the season, while potato yields are higher. Although the observed effects are not sufficiently strong to ensure plant protection without additional insect control measures, they demonstrate an additional benefit of using organic soil amendments.

4. Associated Knowledge Areas

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

Outcome #15

1. Outcome Measures

Number of people improving their understanding about how to manage weed seed rain

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	200

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 #16

1. Outcome Measures

Improved methods for controlling the invasive European fire ant

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The European fire ant is a stinging, invasive ant that attains extremely high densities in infested properties in Maine, and many people have complained that they are unable to use their gardens, and children and pets can no longer frequent their yards. These ants can be particularly problematic in parks, schoolyards and other suburban landscapes along the coast, because of the issue of human and environmental exposure to pesticides.

What has been done

? MAFES entomologists regularly collected colonies of *Mymrica rubra* from infested sites in coastal Maine, holding them for several weeks to observe for mortality. They dissected dying and dead ants and observed them microscopically or surface sterilized and incubated them for emergence of nematode or fungal pathogens. The scientists assessed pathogenicity when possible with reinfection assays. They also explored the culture and production of pathogens on artificial media and in vivo, and looked at methods for facilitating infection.

Results

The researchers found that a number of natural enemies infect the European fire ant in Maine. They are exploring the potential of these natural enemies to infect various life stages of the ants and how they may impact the behavior of colonies. The scientists have found that the ants do not avoid soil treated with inoculum of pathogenic fungi. Worker ants readily crossed and tunneled through fungal treated soil in order to acquire food, and colonies exposed to the treated soil experienced significantly higher mortality than controls. They also found that deployment of food bait stations placed in the center of - m diameter area treated with *B. bassiana* experienced reductions in ant activity at 8 weeks post treatment. This management approach could result in lower densities and fewer problems associated with these ants.

4. Associated Knowledge Areas

KA Code	Knowledge Area
721	Insects and Other Pests Affecting Humans

Outcome #17

1. Outcome Measures

Number of people in Maine trained to identify invasive plants, conduct a field siting and publish their sitings in the VitalSigns system

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	32

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
136	Conservation of Biological Diversity
202	Plant Genetic Resources

205	Plant Management Systems
206	Basic Plant Biology
605	Natural Resource and Environmental Economics

Outcome #18

1. Outcome Measures

Number of possible biological control agents identified for control of Japanese barberry

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

Experiments to identify symbionts associated with invasive populations of Japanese barberry in Acadia National Park led to the identification of a fruit fly, *Rhagoletis meigenii*, in the barberry fruits. This is being explored as a possible biological control agent.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
136	Conservation of Biological Diversity
202	Plant Genetic Resources
205	Plant Management Systems
206	Basic Plant Biology
605	Natural Resource and Environmental Economics

Outcome #19

1. Outcome Measures

Number of participants who completed the full-day training session of the Invasive Plant Atlas of New England

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	11

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

The session included training in plant identification, mapping protocol and the process for submitting information to IPANE. All participants established passwords and entered the IPANE website to identify a piece of land to map. In the 5 months since the training, they have vouchered some samples into IPANE, but the intensive process often requires years to completely map parcels of land. Ultimately, these volunteers' data will support research about invasive plants in Maine.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
136	Conservation of Biological Diversity
202	Plant Genetic Resources
205	Plant Management Systems
206	Basic Plant Biology
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

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

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
135	Aquatic and Terrestrial Wildlife			1%	
301	Reproductive Performance of Animals			15%	
302	Nutrient Utilization in Animals			12%	
303	Genetic Improvement of Animals			4%	
306	Environmental Stress in Animals			4%	
307	Animal Management Systems			9%	
311	Animal Diseases			36%	
312	External Parasites and Pests of Animals			9%	
315	Animal Welfare/Well-Being and Protection			7%	
	Total			97%	

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	5.4	0.0
Actual	0.0	0.0	6.4	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	287423	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	532741	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

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

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2010

Actual: 1

Patents listed

a patent for sea lice treatments

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	9	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of research projects completed, annually

Year	Actual
2010	3

Output #2

Output Measure

- # of papers presented at professional meetings, annually

Year	Actual
2010	16

Output #3

Output Measure

- # of other types of publications, annually

Year	Actual
2010	8

Output #4

Output Measure

- A protocol that measures the overall innate immune health of fish

Year	Actual
2010	1

Output #5

Output Measure

- Statewide prototheca prevalence survey using bulk tank filters from collaborating dairies.

Year	Actual
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2010

1

Output #6

Output Measure

- Amount of extramural funding awarded to faculty working in this program area during university fiscal year 2010

Year

Actual

2010

563716

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of DNA vaccines against infectious pancreatic necrosis virus developed and tested
2	# of thematic maps regarding incidence of lobster shell disease and other environmental factors
3	# of crab-monitoring programs undertaken by coastal communities
4	% increase in Maine's clam catch levels
5	% reduction in the use of live food inputs in diets for larval marine fish
6	Development of an effective vaccine regimen for infectious pancreatic necrosis virus will eliminate the now-mandatory destruction of diseased fish, saving Maine's aquaculture industry money
7	Increase in number of regional dairy farmers using an alternative teat dip
8	Reduction in mastitis will lead to increased income for Maine dairy farms
9	Reduction in use of disinfectant teat dips will have increased benefits for human health
10	Percentage decrease of <i>Candida albicans</i> infection in salmon aquaculture facilities in Maine
11	Number of state and local agencies using information on clam flat settlement
12	Development of a new nested PCR to quickly determine the presence and type of <i>Prototheca</i> in a herd of dairy cattle
13	Creating human and fish pathogens that express a red fluorescent pigment
14	Number of zebrafish host genes identified that were modulated upon pathogen infection
15	Responding to developing needs of Maine's oyster industry
16	Improved understanding of the risk of sea lice infection of wild salmon from salmon farms
17	New vaccination strategies for farmed Atlantic cod against <i>Vibrio anguillarum</i>

18	Better understanding of ways for organic dairy producers to increase their productivity
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Outcome #1

1. Outcome Measures

of DNA vaccines against infectious pancreatic necrosis virus developed and tested

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

of crab-monitoring programs undertaken by coastal communities

Not Reporting on this Outcome Measure

Outcome #4

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
2010	50	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The soft-shell clam is the bivalve fishery with highest landed value in Maine. Landings have been extremely variable over the last century with present landings a quarter or less of their historical highs. Decreased Maine landings are primarily due to decreased harvests in eastern Maine.

What has been done

MAFES researchers compared clam spat counts both from sieved mudflat core samples and from collector pots placed on the flats in eastern Maine and southern Maine, where clam landings have not varied significantly over three decades.

Results

The scientists have found several reasons for recruitment failure in eastern Maine, including new fishing pressure on previously protected breeding stocks; larger tides and shorter flushing times in eastern Maine; predation by introduced species such as the green crab. This research has shown that natural settlement is presently inadequate to repopulate the clam flats in eastern Maine. The researchers have used their findings to develop recommendations for improving soft-shell clam landings in eastern Maine. They recommend stocking these flats with hatchery-reared seed, managing them to limit predation, and closing the flats to harvest until the seed reaches market size.

4. Associated Knowledge Areas

KA Code	Knowledge Area
312	External Parasites and Pests of Animals

Outcome #5

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	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.

What has been done

Due to the emergence of several cases of protothecal mastitis in Maine during 2009-10, MAFES animal scientists shifted focus of their project onto the NE1028's Objective 3, new technologies to advance mastitis control, milk quality and dairy food safety.

Results

A change of action has occurred, in that Maine dairy producers are now aware of the test, and many have participated in the screening process. In the case of one dairy, the owner is collaborating in changing methods of water delivery, cleaning/sanitizing methods, and repeated testing/culling to keep the disease under control. The scientists expect a change of condition, in the sense of better and less expensive animal health when this pathogen is cleared from the farm due to rapid detection and prompt action. The PCR test will be a regular diagnostic tool in their

mastitis lab.

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

Percentage decrease of Candid albicans infection in salmon aquaculture facilities in Maine

Not Reporting on this Outcome Measure

Outcome #11

1. Outcome Measures

Number of state and local agencies using information on clam flat settlement

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

Maine Dept of Marine Resources, West Bath Municipal Clam Committee, Harpswell Municipal Clam Committee, Searsport Municipal Clam Committee, Penobscot Municipal Clam Committee

4. Associated Knowledge Areas

KA Code	Knowledge Area
312	External Parasites and Pests of Animals

Outcome #12

1. Outcome Measures

Development of a new nested PCR to quickly determine the presence and type of Prototheca in a herd of dairy cattle

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	1

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.

What has been done

Due to the emergence of several cases of protothecal mastitis in Maine during 2009-10, MAFES animal scientists shifted focus of their project onto the NE1028's Objective 3, new technologies to advance mastitis control, milk quality and dairy food safety.

Results

The researchers developed a nested PCR to screen bulk tank filters for prototheca, a colorless algae capable of causing bovine mastitis, which has been validated in their lab. They have also conducted a statewide prototheca prevalence survey using bulk tank filters from collaborating

dairies. Development of the nested PCR contributed to a change in knowledge, as an effective means to quickly determine the presence and type of Prototheca in a herd of dairy cattle had not been devised.

4. Associated Knowledge Areas

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

Outcome #13

1. Outcome Measures

Creating human and fish pathogens that express a red fluorescent pigment

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Infectious pancreatic necrosis virus (IPNV) is a member of the Birnaviridae and is a major impediment to salmonid aquaculture. IPN is primarily a disease of fry, with the highest mortality rate in the first 8 weeks of life. However, survivors of infection become life-long carriers of virus and serve as reservoirs for future infection of other fish. The disease has been endemic in Norway where greater than 95% of the farms have had adult fish carrying IPNV.

What has been done

MAFES scientists have created human and fish pathogens that express a red fluorescent pigment. Cells exhibit red fluorescence under blue light and colonies on laboratory medium are deep red. These strains allow real-time interactions between cells of the innate immune system and the bacterial pathogen to be viewed and recorded in live zebrafish.

Results

Results from zebrafish infectivity studies indicate that RFP-labeled pathogens will be useful for the studies of real-time interactions between host cells of the innate immune system and the infecting pathogen. The results have been published and reported at various national and regional meetings, and the created strains have been shared with 20 other laboratories. These

strains are being used by others to quantify bacterial invasiveness, pathogenicity, and clearing of bacterial pathogens by macrophages and neutrophils.

4. Associated Knowledge Areas

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

Outcome #14

1. Outcome Measures

Number of zebrafish host genes identified that were modulated upon pathogen infection

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Although zebrafish are a recognized model for human disease, they can also be used as a model for diseases of fish. By understanding the immune response of our model species, MAFES scientists hope to develop better strategies to enhance the immune response to infectious diseases and to develop more effective vaccines for economically important Maine fish species, such as rainbow trout and Atlantic salmon.

What has been done

MAFES researchers are continuing work on a model system for fish disease control and prevention.

Results

They have identified caveolin-1 as a gene that is modulated upon viral infection and have conducted gene knockdown studies in the zebrafish for this gene.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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311 Animal Diseases

Outcome #15

1. Outcome Measures

Responding to developing needs of Maine's oyster industry

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

An industry partner of MAFES oyster researchers has been beset by a substantial infestation of polychaete (*Polydora websteri*) also known as blister worm. Several of his Eastern oysters have been infected by upwards of 100 worms, which cause the development of mud pockets on the inner surface of the shell and can severely affect marketability of the oyster.

What has been done

Although this research was not part of the original scientists' planned project, they considered it critical due to the potential economic losses for one of their industry partners.

Results

Although the research is in its early stage, the scientists have been investigating several treatments such as short term freezing, brine rinse, and extended cold storage, looking for methods to kill the worms without adversely affecting the oyster host.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
311	Animal Diseases

Outcome #16

1. Outcome Measures

Improved understanding of the risk of sea lice infection of wild salmon from salmon farms

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Maine is one of the leading producers of farm raised marine seafood in the U.S. On a per acre basis, farm raised salmon, oysters and mussels are the most valuable agricultural crops raised in the state. Currently, this industry produces about 20 million pounds of Atlantic salmon (worth about \$60 million), while shellfish contributes a further \$2.6 million. Maine also has the US's only Atlantic cod farms and a small halibut industry. Taken together, aquaculture supports approximately 750 jobs and makes a significant contribution to the rural economy, especially in less affluent regions of Maine. As aquaculture has developed there have been concerns expressed about the sustainability of the industry from other stakeholders in the marine environment.

What has been done

MAFES researchers are investigating the impact disease has on aquaculture and the disease interactions between farmed and wild aquacultured animals. The information the scientists will generate in this research program will be essential in assisting in the correct siting of farms, the development of new treatments for diseases and improved husbandry strategies. One part of this project has concentrated on the difficult and publicly sensitive question "Do salmon farms increase the risk of sea lice infecting the wild population of salmon in Maine?"

Results

Their work has suggested that sea lice are much rarer in the ocean than has been proposed by some distribution models. This suggests that the risk from salmon farms is less than these models have proposed. One key area that they hope to be able to develop further is the retention and distribution of sea lice from farm cages as they suspect that this is overestimated in current dispersion models.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
311	Animal Diseases
312	External Parasites and Pests of Animals

Outcome #17

1. Outcome Measures

New vaccination strategies for farmed Atlantic cod against *Vibrio anguillarum*

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Maine is one of the leading producers of farm raised marine seafood in the U.S. On a per acre basis, farm raised salmon, oysters and mussels are the most valuable agricultural crops raised in the state. Currently, this industry produces about 20 million pounds of Atlantic salmon (worth about \$60 million), while shellfish contributes a further \$2.6 million. Maine also has the US's only Atlantic cod farms and a small halibut industry. Taken together, aquaculture supports approximately 750 jobs and makes a significant contribution to the rural economy, especially in less affluent regions of Maine. As aquaculture has developed there have been concerns expressed about the sustainability of the industry from other stakeholders in the marine environment.

What has been done

MAFES researchers are investigating the impact disease has on aquaculture and the disease interactions between farmed and wild aquacultured animals. The information the scientists will generate in this research program will be essential in assisting in the correct siting of farms, the development of new treatments for diseases and improved husbandry strategies. As part of this project the scientists have continued to develop new vaccination strategies for farmed Atlantic cod against *Vibrio anguillarum*. This has been based on developing both new vaccine formulations and delivery strategies for this pathogen.

Results

The researchers are currently investigating routes of entry of this pathogen into the fish and have identified that, along with the gills and abrasions, the digestive tract is important in the uptake of this pathogen. Protection of the digestive tract is not currently part of the vaccination strategy. Based on this research, they are developing methods to target the gut mucosal immune system. They continue to work with stakeholders in fish health in Maine and the legislature, especially DMR, and to keep the community well informed of this research through open days and a free annual seminar on the relevance of this research to Maine and its economy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
311	Animal Diseases
312	External Parasites and Pests of Animals

Outcome #18

1. Outcome Measures

Better understanding of ways for organic dairy producers to increase their productivity

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Feed is the single largest expense for organic dairy farmers in the Northeast, averaging 44% of the annual operating expenses. Imported grains account for a large portion of the expense; organic grain costs 1.7 to 2.3 times the cost of conventional grains. Farmers are interested in cropping systems that can reduce their feed costs, either by increasing the quality of their forage or by including grains in their rotation.

What has been done

MAFES researchers have been investigating four cropping systems for supplying conserved forages and grains to an organic dairy herd. The economists involved in the project have quantified the net return and exposure to risk and identified the economies of scale for each system, using several techniques to evaluate profitability including the IFSM (Integrated Farming

System Model) from ARS at Penn State and a "bootstrap" method developed by Efron at Stanford.

Results

Results from Maine and NH indicated that feeding a grass-silage-based diet supplemented with commodity concentrates may provide the greatest economic return for New England organic dairy producers. Organic dairy farms in Maine and Vermont now represent more than 20% of all dairy farms in those states.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

- Delays in rehiring the hatchery technician position that is critical to completion of the hatchery phase affected the outcomes of the oyster breeding project as did the loss of a graduate student.
- The substantial infestation of polychaete (*Polydora websteri*) also known as blister worm in an oyster industry partner's operations lead to the addition of a new focus.

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

Evaluation Results

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Foods and Nutrition

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
204	Plant Product Quality and Utility (Preharvest)			13%	
308	Improved Animal Products (Before Harvest)			3%	
501	New and Improved Food Processing Technologies			13%	
502	New and Improved Food Products			9%	
503	Quality Maintenance in Storing and Marketing Food Products			3%	
701	Nutrient Composition of Food			6%	
702	Requirements and Function of Nutrients and Other Food Components			20%	
703	Nutrition Education and Behavior			15%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			6%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			12%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	4.0	0.0
Actual	0.0	0.0	4.1	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	253647	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	508564	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

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

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
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Actual	0	8	0
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V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of other publications

Year	Actual
2010	13

Output #2

Output Measure

- # of papers presented at meetings

Year	Actual
2010	7

Output #3

Output Measure

- # of completed research projects

Year	Actual
2010	0

Output #4

Output Measure

- # of crustacean mince-based products commercialized

Year	Actual
2010	0

Output #5

Output Measure

- # of simple, inexpensive, instrument-free gaseous ClO2 approach for disinfection of fresh produce

Year	Actual
2010	1

Output #6

Output Measure

- # of web-based interventions to improve diets and overall health of young adults piloted (Y.E.A.H. Project--Young Adults Eating and Active for Health).

Year	Actual
2010	1

Output #7

Output Measure

- The NC1028 researchers in collaboration with Interactive Training Technologies, Inc, a multimedia/web-based training corporation, developed the website which includes educational modules (activities); staged-based messages (nudges) delivered as emails and web-based videos, personalized goal setting and tracking of progress.

Year	Actual
2010	1

Output #8

Output Measure

- Glycoalkaloid (TGA) analysis for several potato breeding programs around the country. MAFES scientists have maintained their service of TGA screening for these researchers and have expanded capabilities to help the potato and pet food industries test dried potato meal for TGA levels.

Year	Actual
2010	0

Output #9

Output Measure

- A capsicum cultivar with high levels capsinoids, novel phytochemicals with beneficial health effects. As a joint project with the USDA-ARS. This is the first year of selective breeding for this cultivar and scientists are excited by the capsinoid levels obtained in the fruit from the new plants.

Year	Actual
2010	1

Output #10

Output Measure

- Amount of extramural funding awarded to faculty working in this program area during university fiscal year 2010

Year	Actual
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2010

777885

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of new analytical methods for detecting phytochemicals in foods
2	# of Maine food processors learning about new methods to detect pesticide residues
3	Increase in consumption of fruits and vegetables by targeted young adults
4	Decrease in obesity among young adults taking part in nutrition education program
5	# of food products incorporating nutrition claims of interest to consumers
6	# of new extruded food products containing anthocyanins
7	Number of people newly aware of the health benefits of potatoes
8	Percentage increase in wild blueberry sales
9	Percentage of Maine adults who are overweight or obese
10	Increased use by Maine's blueberry industry of claims of cardiovascular health benefits of wild blueberry consumption
11	Increase in number of Maine crustacean processors producing and/or selling mince
12	New markets for elderberry producers
13	New analytical methods for monitoring organic chemicals in food, water and environmental matrices
14	# of seafood researchers, fishermen, and economic development specialists increasing their knowledge about using the invasive green crab in new food products

Outcome #1

1. Outcome Measures

of new analytical methods for detecting phytochemicals in foods

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	5	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
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

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

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Increase in consumption of fruits and vegetables by targeted young adults

Not Reporting on this Outcome Measure

Outcome #4

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
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Risks of cardiovascular disease, hypertension, and type 2 diabetes are exacerbated by excessive weight gain. Specific strategies are needed to promote healthful eating among young adults, an age group with high risk of weight gain and unique interests in diet/health issues. To date, few interventions have been designed for obesity prevention among young adults.

What has been done

During this year the goal was to develop tailored weight management applications, addressing young adults' eating and physical activity patterns, which incorporate behavioral theoretical constructs and individualized factors that can be refined and evaluated in future projects. A web-based intervention, Y.E.A.H. Project (Young Adults Eating and Active for Health), was piloted and retested in preparation for actual implementation.

Results

: Over this year the partnership between the researchers and the community members at the Job Corps site has strengthened, which increases the sustainability of the project. The researchers found that the Behavior, Environment and Changeability Survey (BECS) may be useful for nutrition educators, researchers and community program designers to understand the needs of a young adult population and provide targeted interventions/programs aimed at preventing obesity

in this age group. Specifically, use of the BECS can help identify factors that enable and encourage healthful eating and physical activity. This partnership with the Penobscot Job Corps 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- to 24-year-olds.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #5

1. Outcome Measures

of food products incorporating nutrition claims of interest to consumers

Not Reporting on this Outcome Measure

Outcome #6

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
2010	2	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 #7

1. Outcome Measures

Number of people newly aware of the health benefits of potatoes

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Percentage increase in wild blueberry sales

Not Reporting on this Outcome Measure

Outcome #9

1. Outcome Measures

Percentage of Maine adults who are overweight or obese

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Cardiovascular disease still remains the leading cause of death in the U.S. despite a steady decline in lives claimed during the past two decades. Various studies have produced substantial evidence linking the consumption of antioxidant-containing fruits and vegetables to reduced risk of cardiovascular disease and improved cardiovascular health. Maine’s wild blueberries are a rich source of potent antioxidants including phenolics acids, tannins, flavonols and anthocyanins. Determining the health benefits of blueberries may have great economic impact on the blueberry industry by increasing marketability and blueberry consumption.

What has been done

MAFES nutritionists fed spontaneously hypertensive rats a control or a wild blueberry diet for eight weeks. After the eight weeks of intervention, the rats were exposed to the compound l-phenylephrine (a vasoconstrictor), with or without l-NG-monomethyl arginine, a compound known to inhibit the enzyme NO synthase (NOS). The scientists found that animals fed a diet supplemented with 8 percent wild blueberries experienced less constriction in blood vessels, compared with animals fed a control diet.

Results

The researchers have found that the high levels anthocyanins, the blue pigment coloring blueberries, introduced through regular consumption of wild blueberries or blueberry extracts, can protect DNA molecules and reduce damage by approximately 30 percent. Supplementing the diet with antioxidant-rich wild blueberries could also benefit human beings with high blood pressure. This research has been featured on the Maine Wild Blueberry Commission’s web site and has been reported in many Maine newspapers and cited in an article on the NutraIngredients-USA.com website, a daily online health and nutrition news service.

4. Associated Knowledge Areas

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

Outcome #11

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	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. This proposal will focus on research and development to support the economic and environmental sustainability of the crustacean (crab and lobster) processing and aquaculture industries in Maine.

What has been done

: MAFES food scientists have been developing economically feasible methods of using the green crab (*Carcinus maenus*) in new food products, to help establish a new fishery for this invasive species and turn it into a valued food resource. Working on two studies, they evaluated the mechanical processing of the green crab and also produced and consumer-tested an empanada containing the green crab mince as a primary ingredient.

Results

They found that it is possible to mechanically process green crabs, with a resulting high mince yield with a low crude lipid content. These results indicate that green crab would be economically viable in processing operations and would retain its quality during extended periods of frozen storage. Results from the empanada test showed that 63% of the panelists would probably or definitely buy green crab and vegetable empanadas if they were available to them locally. In the short term, this project resulted in harvest income for a Maine lobsterman, and the removal of several thousand of these invasive animals from in-shore areas.

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)

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

Outcome #12

1. Outcome Measures

New markets for elderberry producers

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Small business, including those in the agriculture and biotechnology fields constitute the backbone of Maine's economy. Value-added contributions from the agriculture community leverage these positive impacts, including increased revenues and several employment opportunities for rural workers.

What has been done

MAFES food scientists continued use their analytical expertise and resources to help Maine's agricultural and biotech industries grow and find new markets for their products.

Results

Their collaborative approach has helped an elderberry producer launch an elderberry extract that is currently distributed through a major U.S. retailer. A recently funded (USDA) project will allow a joint project to develop other food products with this Maine company.

4. Associated Knowledge Areas

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

Outcome #13

1. Outcome Measures

New analytical methods for monitoring organic chemicals in food, water and environmental matrices

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Small business, including those in the agriculture and biotechnology fields constitute the backbone of Maine's economy. Value-added contributions from the agriculture community leverage these positive impacts, including increased revenues and several employment opportunities for rural workers.

What has been done

MAFES food scientists continued use their analytical expertise and resources to help Maine's agricultural and biotech industries grow and find new markets for their products.

Results

Their work with a small Maine biotech firm in the area of melamine/cyanuric acid analysis has helped the firm to refine its rapid assay kit and has lead to the creation of several well-paid scientific research jobs.

4. Associated Knowledge Areas

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

Outcome #14

1. Outcome Measures

of seafood researchers, fishermen, and economic development specialists increasing their knowledge about using the invasive green crab in new food products

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

At least 100 seafood researchers, local fishermen, and economic development specialists became more knowledgeable about this potential method of mitigating the green crab invasion, and future collaborative research efforts have been discussed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
501	New and Improved Food Processing Technologies
502	New and Improved Food Products

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

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

Economics, Marketing, Policy and Community Development

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
134	Outdoor Recreation			8%	
501	New and Improved Food Processing Technologies			4%	
601	Economics of Agricultural Production and Farm Management			7%	
603	Market Economics			7%	
604	Marketing and Distribution Practices			3%	
605	Natural Resource and Environmental Economics			26%	
606	International Trade and Development			5%	
607	Consumer Economics			2%	
608	Community Resource Planning and Development			26%	
703	Nutrition Education and Behavior			2%	
723	Hazards to Human Health and Safety			10%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	5.0	0.0
Actual	0.0	0.0	5.8	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	439658	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	535774	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**

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**

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Year: 2010

Actual: 0

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

2010	Extension	Research	Total
Actual	0	8	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of other types of publications

Year	Actual
2010	17

Output #2

Output Measure

- # of papers presented at professional meetings

Year	Actual
2010	23

Output #3

Output Measure

- # of research projects completed

Year	Actual
2010	0

Output #4

Output Measure

- # of surveys of agri-food value chains--A telephone survey of 75 agri-food value chains in the northeast, upper midwest and Pacific northwest identified those that met the Agriculture of the Middle (AOTM) criteria of values-based and those that might evolve to meet those criteria

Year	Actual
2010	1

Output #5

Output Measure

- # of food value chain workshops for value chain participants and educators to find common themes across various types of food value chains and to facilitate interaction and extend knowledge generated from project to practitioners, especially farmers who might benefit from organizing and participating in values-based food supply chains--The value chain workshops

were as productive to farmers and marketers already operating value chains as those considering forming or joining chains, especially since it gave current operators an opportunity to share information with their colleagues operating value chains involving other products and in other areas of the country

Year	Actual
2010	2

Output #6

Output Measure

- # of sets of potato production standards that can be incorporated into a production contract in a bio-plastics value chain.

Year	Actual
2010	1

Output #7

Output Measure

- Budgets and supporting documents for grass-fed and natural beef producers in Maine

Year	Actual
2010	0

Output #8

Output Measure

- # of electronic structured surveys for participants in cooperative research and the New England groundfish fishery management process. Semi-structured interviews were conducted with fishermen, fishery managers, scientists, and NGO representatives.

Year	Actual
2010	2

Output #9

Output Measure

- Amount of extramural funding awarded to faculty working in this program area during university fiscal year 2010

Year	Actual
2010	1921196

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	% of natural resource managers surveyed who will use spatial data on land management, land use, and land ownership in Maine
2	# of people developing a better understanding of land management, land use, and land ownership in Maine
3	State agencies will use findings to design more effective health information programs
4	Federal food safety agencies may alter the way they calculate the benefits of food safety programs and may change their food safety program priorities
5	Increased effectiveness of labeling and marketing regulations
6	Number of state agencies and regional tourism groups that will use research results in planning the types and locations of new nature-based tourism initiatives in the northern forest region
7	Number of economic research projects of direct use to Maine citizens, legislators, and community development professionals.
8	Research support for Maine's dairy industry

Outcome #1

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
2010	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Changing landscapes present opportunities and challenges for individuals, firms, communities, and policy-makers. In Maine, natural resources play significant roles in defining the quality of these places and shaping their regional economic options. The abundant and diverse natural resources of these states contribute to market and non-market services valued by both residents and visitors. Unanticipated changes to landscapes and their associated service flows pose unique challenges.

What has been done

MAFES economists are creating new data resources and testing alternative modeling approaches to support improved assessment and modeling of landscape change. Initial results show distinct preferences for public land management programs in rural and urban areas, confirm expectations of different development patterns in urban and rural areas, and suggest opportunities for improving natural resource management strategies at the municipal scale.

Results

If successful, this research will lessen the extent of surprises associated with landscape change, help reduce unexpected negative outcomes, and point towards desirable outcomes. These data and analyses offer improved information to public agencies, non-government organizations, private businesses, and individuals. It is hoped that such information will help them better understand the drivers of ongoing changes and anticipate future changes. The researchers are sharing the results of these analyses with relevant stakeholders, including the US Forest Service, US Environmental Protection Agency, Maine Department of Environmental Protection, Maine State Planning Office, Maine Volunteer Lake Monitoring Program, and Maine Congress of Lake Associations.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	0	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. These changes in consumer behaviors then may lead to changes in producer behaviors.

What has been done

MAFES economists use stated-preference data to estimate consumer willingness to pay (WTP) for food safety vaccines and then simulate the welfare impacts of subsidizing consumer purchases of the vaccine.

Results

The researchers' simulations show large social benefits if vaccines are relatively inexpensive. Their simulation of the impact of an E. coli vaccine with food-safety policy shows that all policies can increase aggregate welfare, though the largest effects are due to vaccine introductions. Firms profit most from vaccine introductions, as this stimulates demand among vaccinated consumers without shifting firm costs. Consumers who would choose not to become vaccinated due to the high vaccine price or lack of awareness benefit most from tighter standards alone. The magnitude and distribution of the impacts we simulate suggest that the introduction of such vaccines could stimulate vigorous discussion about the relative roles of consumers, industry, and government in ensuring safe food.

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 #5

1. Outcome Measures

Increased effectiveness of labeling and marketing regulations

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Number of economic research projects of direct use to Maine citizens, legislators, and community development professionals.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

Research on the impacts of the proposed Oxford casino informed Maine voters about a statewide referendum question appearing on the November ballot. Groups on both sides of the casino issue used results from the study in public debates leading up to the election. The micro-business research informed members of Maine's economic development community about the importance of micro-enterprises to the state's economy and has influenced economic development policy and strategy in Maine. The study on cellular telephone warning labels informed members of a legislative committee, which voted on whether or not a bill should be considered by the full Maine Legislature.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #8

1. Outcome Measures

Research support for Maine's dairy industry

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Maine fluid milk flows to Maine consumers through value chains. A state dairy stabilization program intervenes in that chain with a counter-cyclical income support program that recognizes the desirability of maintaining differently sized dairy farms. The Maine legislature, facing budget shortfalls, has been looking at modifications to this program. Proposed modifications could have affected various industry sectors quite differently.

What has been done

MAFES economists conducted a study of the cost of milk production and then worked directly with Maine legislators to help them understand the results of this cost analysis. Their results show that it costs the majority of Maine farmers \$20.70 per hundredweight to produce milk, whereas the federal set price was \$16.91 per hundredweight.

Results

Using these results, the Maine legislature then formulated Maine dairy income stabilization policy. This Maine statute (Title 7, sec. 3153-B: Dairy stabilization) explicitly incorporates the quantitative results of the MAFES study into the income stabilization program, which helps with the short- and long-run survivability of Maine's dairy industry. Because it costs more to make milk in Maine than anywhere else in the country, the program has helped stabilize the industry and slowed the loss of farms. Still, Maine lost 24 farms in just the past year. This program also indirectly helps maintain Maine's agricultural infrastructure, Maine rural businesses and rural communities.

4. Associated Knowledge Areas

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

{No Data Entered}

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}