

2012 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 2014-2018 Plan of Work continues to be used to evaluate all MAFES projects, regardless of funding source. A total of 28 Hatch, Animal Health, and McIntire-Stennis projects went through the process in FY2012.

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).

Stakeholders emphasized that research on climate change and food safety was important to Maine. MAFES joined with the experiment stations of New Hampshire and Vermont to develop the Northern New England Collaborative Research Funding Program; the focus of the first round of funding will be on adaptation to or mitigation of climate variability and change by agriculture in northern New England.

Expenditure Summary

In our 2012 Plan of Work, the Maine Agricultural & Forest Experiment Station (MAFES) estimated 27.9 SYs for 2012; the actual number of SYs was 36.3 for FY2012. For FY2012 MAFES expended \$2,190,704 (Actual Formula Funds), \$3,656,481 (Actual Matching Funds), \$1,072,178 (Actual All Other Funds), for a total of \$6,919,363. This year we are continuing to report on McIntire-Stennis and Animal Health projects in the appropriate program area. The All Other Funds column for our program areas includes totals spent on these funds (MS and A) and their associated match. Extramural grants awarded are entered as an output for each program area. MAFES researchers in these program areas received a total of \$8,351,665 in grants and contracts in university fiscal year 2012 (July 1, 2012, through June 30, 2012).

Planned Programs

Global Food Security and Hunger--In our 2012 plan of work, we estimated that there would be 12.5 SYs in this program area; the actual amount of SYs allocated for 2012 was 14.8. During FY2012, MAFES expended \$969,965 (Hatch), and \$1,700,932 (1862 Matching), and \$0 (1862 All Other), for a total of \$2,670,897 in this program area; there were 33 research projects in this program area, falling under 20 knowledge areas.

MAFES research in this program area has resulted in a number of outputs for FY2012, including completed projects, peer-reviewed and other publications, presentations at professional meetings, workshops, and other venues. Faculty working in this area brought in \$3,516,418 in extramural funding during university fiscal year 2012.

There were several outcomes in this program area during FY2012. To highlight a few: MAFES scientists have developed a new diagnostic systems for analyzing lobster health; MAFES food scientists have developed an innovations that was adopted by food processing enterprises and new value-added products that can be sold by producers.

Climate Change--In our 2012 plan of work, we estimated that there would be 1.4 SYs in this program area; because we include McIntire-Stennis-funded projects in this report, the actual amount of SYs allocated for 2012 was 3.9. During FY2012, MAFES expended \$222,745 (Hatch), and \$293,309 (1862 Matching), \$318,573 (1862 All Other, includes M-S funds and their state match) for a total of \$834,627 in this program area; there were 7 research projects in this program area, falling under 13 knowledge areas.

MAFES research in this program area has resulted in a number of outputs for FY2012, including completed projects, publications, and presentations at professional meetings, workshops, and other venues. Faculty working in this area brought in \$536,379 in extramural funding during university fiscal year 2012.

There were several outcomes in this program area during FY2012. To highlight a few: MAFES researchers developed new knowledge on shortnose sturgeon wintering habitats and transferred it to clientele to address the effects of climate variability and change. MAFES resource economists helped create improvements in federal, state, local and private institutional decision-making with respect to managing public and private lands by reducing risks associated with natural hazards such as fire, invasive species, weather-related natural events, and climate change.

Sustainable Energy--In our 2012 plan of work, we estimated that there would be 1.0 SYs in this program area; because we include McIntire-Stennis-funded projects in this report, the actual amount of SYs allocated for 2012 2.5. During FY2012, MAFES expended \$84,429 (Hatch), and \$110,571 (1862 Matching), \$125,676 (1862 All Other, includes M-S funds and their state match) for a total of \$320,676 in this program area; there were 4 research projects in this program area, falling under 6 knowledge areas.

Because faculty for four ongoing projects in this program area left the University of Maine for positions at other universities, their projects were terminated early. There is currently one active project in this program area, which just started this past fall so there are no results yet. Since the program area is so small, we have decided to add this project to our Supporting Maine's Rural Communities program area for the 2014 update, and discontinue this program area.

Childhood Obesity--In our 2012 plan of work, we estimated that there would be 1.1 SYs in this program area; the actual amount of SYs allocated for 2012 was 0.7. During FY2012, MAFES expended \$45,594 (Hatch), \$159,216 (1862 Matching), and \$0 (1862 All Other) for a total of \$204,810 in this program area; there were 2 research projects in this program area, falling under 3 knowledge areas.

Research in this program area has resulted in a number of outputs for FY2012, including publications, presentations at professional meetings, workshops, and at other venues.

One of the two projects in this program area has terminated, so we have decided to move this project into the Global Food Security and Hunger program area for the 2014 update and discontinue this program area.

Food Safety--In our 2012 plan of work, we estimated that there would be 2.6 SYs in this program area; the actual amount of SYs expended for 2012 was 2.7. During FY2012, MAFES expended \$230,114 (Hatch), and \$400,569 (1862 Matching), \$0 (1862 All Other) for a total of \$630,683 in this program area; there were 4 research projects in this program area, falling under 9 knowledge areas.

MAFES research in this program area has resulted in a number of outputs for FY2012, including publications, presentations at professional meetings, workshops, and other venues, and systems for detecting particular food pathogens. Faculty working in this area brought in \$245,000 in extramural funding during university fiscal year 2012.

There were several outcomes in this program area during FY2012. To highlight two: MAFES food scientists have established a simple predictive model based on the correlation of catalase activity and

viable microbial counts for celery, bell pepper and ready-to-eat salad (lettuce); and Maine's Center for Disease control redesigned its fish consumption advisory based on the results MAFES economists' research.

Sustaining Maine's Natural Resources--In our 2012 plan of work, we estimated that there would be 5.4 SYs in this program area; because we include McIntire-Stennis funds in this report, the actual amount of SYs expended for 2012 was 6.9. During FY2012, MAFES expended \$332,717 (Hatch), \$610,042 (1862 Matching), and \$363,425 (1862 All Other, includes M-S funds and their state match) for a total of \$1,306,184 in this program area. There were 14 research projects in this program area, falling under 11 knowledge areas.

MAFES research in this program area has resulted in a number of outputs for FY2012, including completed projects, peer-reviewed and other publications, and presentations at professional meetings, workshops, and other venues. Faculty working in this area brought in \$1,635,254 in extramural funding during university fiscal year 2012.

There were several outcomes in this program area during FY2012. To highlight a couple: Based on MAFES research on the diversity of among Arctic charr populations in Maine, management agencies (MDIFW), local interest groups and NGOs (TU, The Nature Conservancy) are now emphasizing the importance of local populations in management of both healthy and imperiled populations in Maine. A report written by MAFES scientists, titled "A landscape planning initiative for northern Maine using area-sensitive umbrella species," (July 2011) has been used as the foundation for a multi-species forest management plan implemented by The Nature Conservancy across 186,000 acres of northern Maine.

Supporting Maine's Rural Communities--In our 2012 plan of work, we estimated that there would be 4.4 SYs in this program area; because we include McIntire-Stennis and Animal Health funds in this report, the actual amount of SYs expended for 2012 was 5.6. During FY2012, MAFES expended \$285,140 (Hatch), \$381,842 (1862 Matching) and \$264,504 (1862 All Other, includes M-S and AH funds and their state match) for a total of \$931,486 in this program area. There were 13 research projects in this program area, falling under 13 knowledge areas.

MAFES research in this program area has resulted in a number of outputs for FY2012, including completed projects, peer-reviewed and other publications, and presentations at professional meetings, workshops, and other venues. Faculty working in this area brought in \$445,523 in extramural funding during university fiscal year 2012.

There were several outcomes in this program area during FY2012. To highlight a couple: MAFES researchers have started strangles eradication programs; through a partnership with IDEXX Corporation the researchers provide strangles diagnosis at no-cost to the client. MAFES research on policy solutions to address issues of public access to private land influenced the successful passing of a Maine law, LD1613, "An Act to Strengthen the Relationships between Landowners and Land Users."

Total Actual Amount of professional FTEs/SYs for this State

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	27.9	0.0
Actual	0.0	0.0	37.1	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 Plan of Work 2014 update continues to be used to evaluate the scientific and societal significance of all proposed MAFES projects, regardless of funding source. A total of 28 Hatch, Animal Health, and McIntire-Stennis projects went through the process in FY2012.

All research MAFES-funded projects go through three reviews. First, all pre-proposals are reviewed by the MAFES Research Council, which is comprised of senior faculty who have an established record of high productivity and high-quality research. The Research Council reviews the pre-proposals to ensure that the proposed work falls within the purview of MAFES, addresses an important need identified by stakeholders, and that the faculty member submitting the pre-proposal possesses the expertise to conduct the research. Once approved by the Research Council, pre-proposals are distributed to advisory committees to elicit their input on the importance of the issues addressed within the pre-proposals.

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

III. Stakeholder Input

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

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of the general public

Brief explanation.

The Maine Agricultural & Forest Experiment Station encouraged stakeholder input by hosting (along with the college leadership) 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 legislators, one Board of Agriculture meeting was held in the state capitol building.

The associate director attended a legislator's tour of Maine's wild blueberry industry, which included participation by local growers and presentations on the station's research programs. Associated discussions help inform the station on current research needs. The director and associate director also take part on on-campus legislative tours.

Other key stakeholder 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. A committee of horticultural professionals along with the associate director approves research proposals supported by a horticulture fund. Feedback from these committees provides information on research priorities and needs for these commodity groups.

The director and associate director discussed current research programs with legislators at two college exhibitions at the State House, one in association with the agricultural industry. The associate director of MAFES attended monthly meetings of the Agricultural Council of Maine (AGCOM) as a way to maintain effective communication with the wide array of agricultural organizations in the state. These meetings provide MAFES administration with good information on issues important to Maine's agricultural community. The associate director helped develop AGCOM's strategic plan for 2013-2020: "Growing Maine: Strategies for Expanding Maine's Food and Farm Economy."

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

MAFES faculty, through their interaction with stakeholder groups and individuals in both formal and informal settings, also continued to encourage stakeholder participation. Our research facilities hosted field days for apples, small fruits, and vegetables, potatoes, grains, and wild blueberries and other interests of growers, 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
- Needs Assessments

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 stakeholder groups, 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.

To collect input from agricultural stakeholders, the associate director conducted a research and extension needs assessment of Maine agricultural organizations for the Board of Agriculture. The results were shared with board members and discussed at the spring 2012 board meeting.

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. To collect input from agricultural stakeholders, the associate director conducted a research and extension needs assessment of Maine agricultural organizations for the Board of Agriculture. The results were shared with board members and discussed at the spring 2012 board meeting. Faculty researchers meet with and collect input from both traditional and nontraditional stakeholders at the group and individual level.

3. A statement of how the input will be considered

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

Brief explanation.

Input was used internally to evaluate research, outreach and hiring priorities for MAFES and the Maine Agricultural Center (MAC). As noted above, some stakeholder groups provide direct input during project approval processes. Based on the input received and the priorities set by the Board of

Agriculture and Forest Research Advisory Committee, critical areas were identified for emphasis and support. Since agriculture is a dynamic industry, MAC/MAFES needs to update long-range plans, and will rely on the recently completed strategic plan of the Agricultural Council of Maine. Faculty, where appropriate, develop their research proposals to address the stated concerns of stakeholders.

Brief Explanation of what you learned from your Stakeholders

Based on the needs assessment of agricultural research and extension priority areas, station administrators have learned that stakeholders would like more research on food safety, climate change, and agricultural economics. As part of the newly created Northern New England Collaborative Research Funding Program, Maine has joined with the New Hampshire and Vermont experiment stations to encourage regional collaborative research projects. To address the need for research on climate change, the focus of the first round of funding will be on adaptation to or mitigation of climate variability and change by agriculture in northern New England. Agriculture industry leaders also see a need for more farming-specific training programs. The college is responding to this need by working with industry to develop more internship programs.

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	2340175	0

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	2190704	0
Actual Matching	0	0	3656481	0
Actual All Other	0	0	1072178	0
Total Actual Expended	0	0	6919363	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	325214	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Global Food Security and Hunger
2	Climate Change
3	Sustainable Energy
4	Childhood Obesity
5	Food Safety
6	Sustaining Natural Resources
7	Supporting Rural Economies

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

Global Food Security and Hunger

 Reporting on this Program**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			13%	
202	Plant Genetic Resources			7%	
204	Plant Product Quality and Utility (Preharvest)			3%	
205	Plant Management Systems			13%	
211	Insects, Mites, and Other Arthropods Affecting Plants			6%	
212	Pathogens and Nematodes Affecting Plants			9%	
213	Weeds Affecting Plants			7%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants			1%	
216	Integrated Pest Management Systems			2%	
301	Reproductive Performance of Animals			4%	
302	Nutrient Utilization in Animals			3%	
303	Genetic Improvement of Animals			1%	
305	Animal Physiological Processes			2%	
311	Animal Diseases			12%	
501	New and Improved Food Processing Technologies			3%	
502	New and Improved Food Products			2%	
601	Economics of Agricultural Production and Farm Management			3%	
605	Natural Resource and Environmental Economics			3%	
702	Requirements and Function of Nutrients and Other Food Components			3%	
901	Program and Project Design, and Statistics			3%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	12.5	0.0
Actual Paid Professional	0.0	0.0	14.8	0.0
Actual Volunteer	0.0	0.0	0.0	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	989965	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	1700932	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 scientific research. Publish peer-reviewed journal articles and other publications. Present findings at professional meetings, at field days for growers, and at other venues. Educate undergraduate and graduate students.

2. Brief description of the target audience

Maine crop and livestock farmers, aquaculture industry, food processors and marketers, Cooperative Extension staff, other scientists, state policymakers, regulators, and legislators, classroom teachers

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012
 Actual: {No Data Entered}

Patents listed
 {No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	10	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Mathematical model on sea lice settlement risks for fish-farmed embayments in Maine
 Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of crustacean mince-based products commercialized
 Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of completed research projects

Year	Actual
2012	11

Output #4

Output Measure

- Number of other publications

Year	Actual
2012	19

Output #5

Output Measure

- Number of public presentations

Year	Actual
2012	60

Output #6

Output Measure

- database management system, Web portal, define data submission procedures, and a set of annual report products including charts, maps and tables for lobster settlement

Year	Actual
2012	1

Output #7

Output Measure

- Blog posts, answering machine messages and email alerts from April 3 to May 18 on mummy berry disease.

Year	Actual
2012	1

Output #8

Output Measure

- Visitor-friendly displays such as a touch tank filled with aquaculture species such as native and European oysters, scallops and Abalones along with large recirculation reef tank, and a new fish hatchery.

Year	Actual
2012	1

Output #9

Output Measure

- Extensive lesson plans on aquaculture for K-12 education

Year	Actual
2012	1

Output #10

Output Measure

- A searchable online resource on weeding tools where growers can find profiles on any of the 34 tools tested (umaine.edu/weedecology).

Year	Actual
2012	1

Output #11

Output Measure

- \$3,516,418 in extramural grant funding

Year	Actual
2012	3516418

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

O. No.	OUTCOME NAME
1	Percentage of Maine lowbush blueberry growers surveyed who are changing their fertilization practices due to information provided by the fertility research program
2	Number of Maine vegetable and/or grain producers increasing their knowledge of biologically based nutrient sources and how to manage them
3	Number of Maine vegetable and/or grain producers adopting soil testing or other practices to improve the efficiency of their soil fertility programs as indicated by reduced nutrient inputs, improved yields, or both
4	Development of a basic vaccine against the emerging fish pathogen <i>Francisella philomiragia</i> subsp. <i>Noatunensis</i>
5	Development of best husbandry practices for polyculture fish farms
6	Number of dairy producers modifying their forage management procedures by including the use of a silage additive
7	Increase in number of organic potato growers using biocontrol and mutualistic microorganisms to improve disease management, enhance crop yields, and increase soil fertility
8	More potato breeders will start using transgenic lines carrying novel R-genes from <i>S. bulbocastanum</i> as donors in their variety development programs
9	Release of at least one new eastern oyster broodstock to the oyster culture industry
10	Increase production efficiency and market share for Maine's oyster growers
11	Increase in number of crustacean processors in Maine producing/selling mince
12	Increased production of wild blueberries through proper management of weeds, diseases, and insect pests
13	Number of organic and sustainable Maine growers adopting the use of the most ecologically and economically efficient nutrient amendments to supplement or improve their current nutrient management systems
14	Percentage decline in use of nutrient amendments that pose a net-negative impact on soil or water systems in Maine
15	Number of Maine vegetable growers practicing crop rotation in hoop houses by growing alternative crops
16	Percentage of Maine potato producers adding organic amendments to improve soil quality
17	# of commercial-scale tests of new high-yielding, high-quality, and/or pest-resistant potato clones tested in Maine

18	# of new high-yielding, high-quality, and/or pest-resistant potato clones named and released by the Maine Potato Breeding Program
19	Reduced pesticide use and/or improved marketable yields on acres planted to new pest-resistant potato cultivars in Maine
20	Number of Maine potato farmers adjusting their aphid management practices to take maximum advantage of natural population regulation
21	Percentage decrease on Maine potato farms in the use of broad-spectrum insecticides for aphid control, annually
22	Percentage of potato producers receiving information on programs which can lead to more efficient use of N, P and K fertilizers
23	Percentage of potato producers conducting small-scale adoption trials using lower rates of N, P and K fertilizers
24	Percentage of potato producers conducting small-scale adoption trials of late blight resistant varieties and associated reduced chemical fungicide programs
25	Percentage of potato producers adopting fertilization programs with reduced rates of N, P 24 and K fertilizers
26	Percentage of potato producers adopting late blight resistant varieties and associated reduced chemical fungicide programs
27	Number of new or improved innovations developed for food enterprises
28	Number of new or improved value-added products that can be sold by producers (and other members of the food supply chain)
29	Number of innovations adopted in food processing enterprises
30	Number of new innovations developed for Maine's shellfish growers
31	Number of new innovations developed to aid Maine's lobster industry
32	Adoption of best practices and technologies resulting in increased yields, reduced inputs, increased efficiency, increased economic return, and conservation of resources--a. Number of producers indicating adoption of recommended practices:
33	Enhance capacity of a sustainable global food system including new/improved plants, animals, technologies, and management systems--New potato varieties
34	More sustainable, diverse, and resilient food systems in Maine
35	Maine blueberry farmers increase their knowledge of best practices for managing their crops
36	Number of new diagnostic systems analyzing plant and animal pests and diseases

Outcome #1

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 #2

1. Outcome Measures

Number of Maine vegetable and/or grain producers increasing their knowledge of biologically based nutrient sources and how to manage them

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	700

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Interest in using biologically based sources of nitrogen to meet crop needs is increasing in New England. Continuing expansion of certified organic crop production, which must rely on organic sources for the bulk of nutrient inputs, over the last decade has contributed to this increase. Concurrently, the recent volatility in prices for synthetic fertilizers has led many conventional farmers in New England to look toward alternative nutrient sources. Yet farmers find that managing nutrients from biologically based sources has inherent challenges, not least of which is a relative scarcity of practical information and tools to guide their nutrient management decisions.

What has been done

University of Maine researchers evaluated biologically based fertility strategies for wild blueberries, for which poor soil quality is recognized as a key yield-limiting factor. They also evaluated biologically based fertility strategies for organic bread wheat, an emerging crop in New England.

Results

The three experiments conducted in this project increased researcher and participant knowledge in how to manage nutrients in biologically based fertility systems. Results were shared with approximately 700 Maine farmers at conferences, hands-on workshops, and grower field days.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems

Outcome #3

1. Outcome Measures

Number of Maine vegetable and/or grain producers adopting soil testing or other practices to improve the efficiency of their soil fertility programs as indicated by reduced nutrient inputs, improved yields, or both

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Development of a basic vaccine against the emerging fish pathogen *Francisella philomiragia* subsp. *Noatunensis*

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The prevention of infectious disease in fish by vaccination is well established especially for the established farmed species such as Atlantic salmon and Atlantic halibut. However, the commercialization of other species such as Atlantic cod presents new problems. Atlantic cod have brought a new cohort of pathogens with them into culture such as *Francisella philomiragia* subsp. *noatunensis* (FPN), but Atlantic cod do not respond well, at least immunologically, to the current

vaccine technology developed for Atlantic salmon.

What has been done

University of Maine scientists are investigating the control of aquatic animal diseases by immunotherapeutics, such as vaccines and immunostimulants. The researchers continue to work with stakeholders in fish health in Maine and the legislature, especially Department of Marine Resources, and they continue to keep the community well informed of their research through open days and a free annual seminar on the relevance of this research to Maine and its economy.

Results

As a result of their work with the biotechnology industry in Maine on developing and testing vaccines for emerging diseases, the scientists are currently carrying out a series of trials to confirm the efficacy of two new vaccines with a view to commercialization with a Maine company.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases

Outcome #5

1. Outcome Measures

Development of best husbandry practices for polyculture fish farms

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of dairy producers modifying their forage management procedures by including the use of a silage additive

Not Reporting on this Outcome Measure

Outcome #7

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 #8

1. Outcome Measures

More potato breeders will start using transgenic lines carrying novel R-genes from *S. bulbocastanum* as donors in their variety development programs

Not Reporting on this Outcome Measure

Outcome #9

1. Outcome Measures

Release of at least one new eastern oyster broodstock to the oyster culture industry

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

Increase production efficiency and market share for Maine's oyster growers

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Oyster culture comprises a growing portion of the aquaculture production in Maine waters. In 2006, the harvest of eastern oysters was worth more than \$1.4 million with >3 million oysters harvested, representing a 67% increase over the 2005 harvest. Outbreaks of disease, however, still cause considerable damage to the industry and limit its expansion.

What has been done

University of Maine marine scientists deployed a series of oyster lines with demonstrated resistance to the oyster diseases MSX, Dermo, and ROD along with hybrid lines generated by crossing these disease-resistant lines at six sites from New Jersey to Maine in late July and

August of 2011. They then monitored the growth and survival of oysters for two full seasons.

Results

Oyster hatcheries have adopted the approach of hybridizing genetic lines of oysters to achieve additional gains in growth and survival. The researchers plan to make the actual lines used in their current project available to commercial hatcheries at the conclusion of our project.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals

Outcome #11

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #12

1. Outcome Measures

Increased production of wild blueberries through proper management of weeds, diseases, and insect pests

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Fine leaf sheep fescue (*Festuca filiformis*) is an introduced perennial grass in Maine wild blueberry fields, and growers in the Jonesport, ME, area recently reported an herbicide-resistant population that has begun taking over local fields.

What has been done

University of Maine scientists evaluated both herbicides registered for use on wild blueberry and unregistered herbicides for control of fine leaf sheep fescue and other weeds and injury to blueberry. Kerb 50W (2 lb/a) was applied in fall 2011 and pre-emergence in spring 2012. Sinbar WDG (2 lb/a)/Direx 4L (2 lb/a)/Velpar L (1 lb/a) or Trimix, Matrix SG (4 oz/a) and Lorox DF(2 lb/a) were also applied pre-emergence, and Arrow (8 oz/a) and Option (1.5 oz/a) were applied twice post-emergence.

Results

They found that fall-applied Kerb resulted in the highest blueberry cover. Lorox and Option had significantly higher initial phytotoxicity, but overall levels were not unacceptably high, and the plants grew out of it with the exception of minor phytotoxicity in August in the Lorox treatment. Fall Kerb was also significantly and consistently most effective in controlling fine leaf sheep fescue over time, followed closely by Matrix, while Arrow and Lorox were consistently ineffective. In conclusion, fall application of Kerb and pre-emergence application of Matrix controlled fine leaf sheep fescue, and Trimix could be effective with low fine leaf sheep fescue pressure. Arrow, Lorox, and spring application of Kerb and Option were not effective if there is sheep fescue and/or broadleaf weed pressure. This research will be important to Maine’s 575 wild blueberry growers who produce an average of 80 million pounds per year. Maine produces 15 percent of the North American blueberry crop and 40 percent of the wild blueberry crop. Successful adoption of these practices will ensure that wild blueberry growers in Maine can produce a crop efficiently and remain competitive in the world marketplace in future years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants

Outcome #13

1. Outcome Measures

Number of organic and sustainable Maine growers adopting the use of the most ecologically and economically efficient nutrient amendments to supplement or improve their current nutrient management systems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

The dissemination of information from this research project has led to at least 10 organic farmers in Maine changing their fertility regime to use organic fertilizers of a different type or sources to increase ecological and economic benefits. Target audiences were primarily organic vegetable and grain growers who were members of the Maine Organic Farmers and Growers Association. However, the researcher fielded questions from farmers from at least six different East Coast states who were looking for advice on alternative N fertilizers and from three extension educators from outside Maine who wanted data and summaries from the trials related to this work.

4. Associated Knowledge Areas

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

Outcome #14

1. Outcome Measures

Percentage decline in use of nutrient amendments that pose a net-negative impact on soil or water systems in Maine

Not Reporting on this Outcome Measure

Outcome #15

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #16

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Conventional potato production in cool, humid regions such as Maine is often characterized by soil degradation, high pressure from soilborne plant pathogens, and high inputs of fertilizers and pesticides. Soil degradation can be counteracted by adding organic amendments to soil. Compost is widely recognized to be a beneficial soil conditioner. However, how well compost is able to increase soil aggregation and to supply nitrogen is uncertain.

What has been done

University of Maine soil scientists studied a range of compost types, all produced in Maine, under laboratory and field conditions. Poultry manure is another organic amendment, produced in Maine, which may be beneficially applied to soils to build organic matter and supply plant nutrients, particularly phosphorus. However amending soils with poultry manure to meet plant need for nitrogen, or disposing of excess manure on soils, may lead to over application of phosphorus and accumulation of phosphorus in solid phases. The reactions of poultry manure phosphorus with soils were examined in laboratory and greenhouse studies.

Results

Although several composts appeared to help maintain small aggregate stability, none appeared to increase it. Immature composts had the greatest effects on soil properties, but generally are not suitable soil amendments due to possible introduction of phytotoxic compounds. One mature compost, produced using a unique process, both stimulated soil microbial activity and maintained levels of soluble nitrogen in soils. Amending soils with poultry manure increased levels of soluble phosphorus and promoted transformation of mineral-bound phosphorus to soluble phosphorus, which was then available for plant uptake. It is hoped that research-based information on the effects of soil amendments such as compost and manure will help accelerate the use of these amendments on-farm to improve soil quality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
204	Plant Product Quality and Utility (Preharvest)
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants

Outcome #17

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	Actual
2012	16

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

To facilitate the process of growers adopting new potato varieties, University of Maine researchers coordinated 16 commercial-scale trials representing 11 new potato varieties (4 chippers, 3 russets, 2 reds, and 2 specialty market yellow fleshed) and 156 acres during 2012. Additional commercial trials were conducted in the other participating states. AF0338-17, AF3001-6, and AF3362-1 were among the clones in these commercial trials. If these varieties perform well their production will expand over time. Depending on the characteristics of the specific potato variety, the potential benefits of adoption include new marketing opportunities, more efficient processing, higher yields, better nutritional value, reduced pesticide costs, and less risk of losses to stress, diseases, and pests.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants

Outcome #18

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1

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

During 2012, the project distributed seed potatoes for 20 regional potato variety trials conducted in eight states and two Canadian provinces. Eleven standard varieties and 26 numbered clones were tested for yield, tuber quality, and pest resistance. NE1031 Regional potato variety trials were conducted at three Maine locations during 2012. The regional trial sites (numbers of clones tested) were Presque Isle (41), St Agatha (32), and Exeter (20). Each regional trial site reports results to their local stakeholders and submits their data to the project website coordinator located in NC. The data are entered into a searchable database so that results are accessible to stakeholders and researchers anywhere in the world.

Results

Elkton (B1992-106) was released in 2012, while AF0338-17, AF3001-6, and AF3362-1 are slated for 2013 release. Based on 2011-12 results, AF0338-17, AF4157-6, and NY148 were the most outstanding chipping prospects, AF4013-3 was a promising yellow-fleshed, specialty clone, while Modoc was the best performing red-skinned clone. Classic Russet, AF3362-1, and AF3001-6 were the top performing russeted clones. Lamoka (NY139), Waneta (NY138), and Red Maria (NY129) are three 2010-2011 releases that are attracting commercial interest.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants

Outcome #19

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 #20

1. Outcome Measures

Number of Maine potato farmers adjusting their aphid management practices to take maximum advantage of natural population regulation

Not Reporting on this Outcome Measure

Outcome #21

1. Outcome Measures

Percentage decrease on Maine potato farms in the use of broad-spectrum insecticides for aphid control, annually

Not Reporting on this Outcome Measure

Outcome #22

1. Outcome Measures

Percentage of potato producers receiving information on programs which can lead to more efficient use of N, P and K fertilizers

Not Reporting on this Outcome Measure

Outcome #23

1. Outcome Measures

Percentage of potato producers conducting small-scale adoption trials using lower rates of N, P and K fertilizers

Not Reporting on this Outcome Measure

Outcome #24

1. Outcome Measures

Percentage of potato producers conducting small-scale adoption trials of late blight resistant varieties and associated reduced chemical fungicide programs

Not Reporting on this Outcome Measure

Outcome #25

1. Outcome Measures

Percentage of potato producers adopting fertilization programs with reduced rates of N, P 24 and K fertilizers

Not Reporting on this Outcome Measure

Outcome #26

1. Outcome Measures

Percentage of potato producers adopting late blight resistant varieties and associated reduced chemical fungicide programs

Not Reporting on this Outcome Measure

Outcome #27

1. Outcome Measures

Number of new or improved innovations developed for food enterprises

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

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. One aspect of this sustainability involves developing new value-added products using underutilized species or byproducts of seafood/fish processing.

What has been done

To this end, University of Maine food scientists continued their fish-oil fortification studies, with a focus on shelf-stable, intermediate-moisture foods. A grain-based nutrition bar was selected since it fits the criteria and because nutrition bars have become a popular, portable snack food. The scientists fortified whole-grain-based nutrition bars with four levels of a nonemulsified, nonpurified commercially available fish oil. Then they evaluated the baked nutrition bars for proximate composition, water activity, omega-3 fatty acids, oxidative stability, and consumer acceptance.

Results

The results of the study on fortifying nutrition bars with fish oil suggest that nonemulsified, nonencapsulated fish oil can successfully replace canola oil in intermediate-moisture nutrition bars to provide EPA and DHA levels as high as 178 mg/serving without affecting consumer acceptability or oxidative stability. Most commercially available omega-3-enriched products are enriched with flaxseed or algal oils, at very low levels (32 mg EPA/DHA). There is abundant evidence supporting the health benefits of long-chain omega-3 fatty acids for cardiovascular, neurological, and fetal health, but far too few people consume the recommended intake of these important oils. The fortification of commonly consumed products such as shelf-stable nutrition bars with omega-3-rich fish oil may increase consumption of omega-3 fatty acids among U.S. consumers who do not meet the recommended intake of two servings of fatty fish per week and contribute to improved health status.

4. Associated Knowledge Areas

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

Outcome #28

1. Outcome Measures

Number of new or improved value-added products that can be sold by producers (and other members of the food supply chain)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

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. One aspect of this sustainability involves developing new value-added products using underutilized species or byproducts of seafood/fish processing.

What has been done

To this end, University of Maine food scientists continued their fish-oil fortification studies, with a focus on shelf-stable, intermediate-moisture foods. When an opportunity arose to partner with a local Maine artisanal cheese producer, the scientists began developing a fish-oil-fortified goat cheese in a project funded by the Maine Technology Institute.

Results

The scientists were able to fortify goat cheese with fish oil to successfully make an FDA "Excellent Source" claim, both in the University of Maine's pilot plant facility and in a scale-up process on location at Seal Cove Farm. They used encapsulated, odorless and flavorless, omega-3-rich fish oil to produce a heart-healthy soft goat cheese without adversely affecting sensory quality or oxidative stability of the cheese. The goat cheese may be fortified to deliver up to 1.1 g long-chain omega-3 fatty acids per 30 g serving without affecting consumer purchase intent and up to 1.5 g without affecting oxidative stability. Of the 30 participants who rated the fortified cheese at the Seal Cove retail facility, all liked the cheese "very much," and indicated they would be willing to pay \$0.50-\$0.75 more per round of goat cheese for the fortified samples. The UMaine scientists also partnered with the Agricultural Research Service in Fairbanks, AK, to produce a cream cheese fortified with smoked salmon oil. They evaluated the effect of antioxidants on stability of the fortified cream cheese and determined the optimal level of fortification based on consumer acceptability. In contrast to the goat cheese where the scientists minimized the fish flavor, for the cream cheese, they wanted to deliver a distinctive smoked

salmon taste. Results indicate that cream cheese may be fortified with smoked salmon oil to deliver 800 mg EPA+DHA per serving without affecting consumer acceptability or oxidative stability. Low levels (200 ppm) of mixed tocopherols and green tea were equally effective at preventing oxidation of the fortified cheese.

4. Associated Knowledge Areas

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

Outcome #29

1. Outcome Measures

Number of innovations adopted in food processing enterprises

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Enzymatic browning is a well-documented issue that negatively affects the fruit and vegetable industry. An estimated 50% of fruit is ruined from enzymatic browning losses.

What has been done

University of Maine food scientists have developed a new technique to improve the quality of fresh-cut and processed Maine potatoes to reduce enzymatic browning and acrylamide content upon frying, and to reduce after-cooking darkening. They compared sodium acid sulfate (SAS) and citric acid to a control to determine the effectiveness of each treatment as an anti-browning inhibitor.

Results

Prior to this research, sodium acid sulfate was only used as an acidulant in beverages in the food industry. Now, however, companies, in the U.S. and worldwide, are using SAS to reduce potential enzymatic browning in fresh-cut fruits and vegetables. Jones-Hamilton Company, the company that produces SAS, uses the findings from this research when recommending to other companies on how to incorporate SAS dips in their processing as an anti-browning aid. Although citric acid

was commonly used to reduce enzymatic browning by the fruit and vegetable industry, SAS is a less expensive alternative given the price of citric has been rising for the past five years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

Outcome #30

1. Outcome Measures

Number of new innovations developed for Maine's shellfish growers

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Due to inadequate external funding for part of their oyster project, University of Maine marine scientists initiated a new project intended to overcome the bottlenecks associated with the production of razor clam seed in the hatchery and provide the means for Maine's shellfish hatcheries to begin supplying razor clam seed to the industry.

What has been done

During the spring and summer of 2012, the scientists conducted several razor clams spawning, reared the larvae to settlement, and successfully induced the larvae to settle using a variety of substrates. They found that the survival of recently settled spat can be quite high when the spat are reared in fine to coarse sand sediment trays.

Results

The scientists shared their findings on razor clams at two Razor Clam Roundtable Workshops. At these workshops, they provided interested industry participants with information on the culture of razor clams and solicited ideas on how to implement improvements in hatchery and grow-out culture of this species. These workshops generated substantial enthusiasm for adopting the culture of razor clams. Now that they have identified approaches to increase the production of razor clam seed, the scientists hope to capitalize on this enthusiasm in a follow-up project testing field culture methodologies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
305	Animal Physiological Processes

Outcome #31

1. Outcome Measures

Number of new innovations developed to aid Maine's lobster industry

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The American lobster is the most valuable single-species fishery in New England and Atlantic Canada, valued at approximately US\$1 billion (FAO 2009). The collapse of this fishery would be catastrophic to Maine's coastal economy and change the face of its unique working waterfront.

What has been done

University of Maine researchers, working with the American Lobster Settlement Index (ALSI), have constructed a database management system, Web portal, defined data submission procedures, and a set of annual report products including charts, maps and tables to be posted on the Website and disseminated to stakeholders in annual reports.

Results

The most important impact of completing this objective is to have the first standardized US-Canada time-series database on lobster early life stages. The "change in action" that this provides is that the Web portal puts the entire 24-year data set at the finger tips of the collaborative. This, in turn, should facilitate retrospective analyses of the data that will result in a "change in knowledge." All ALSI participants will be able to mine the data set to address questions of their own.

4. Associated Knowledge Areas

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

Outcome #32

1. Outcome Measures

Adoption of best practices and technologies resulting in increased yields, reduced inputs, increased efficiency, increased economic return, and conservation of resources--a. Number of producers indicating adoption of recommended practices:

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	23

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Demand for local organic food has inspired new interest in growing bread-quality wheat in New England. Our region's farmers have long produced small grains for animal feed on dairy and crop farms, but lack local knowledge and research information regarding production for the organic bread market. University of Maine researchers are part of a project that aims to build farmers' capacity to produce high-quality organic bread wheat.

What has been done

Researchers conducted five research projects in both Maine and Vermont to investigate key production issues with organic bread wheat. Variety trials of 18 winter and 22 spring bread wheat varieties were repeated for the third year at four sites to identify regionally adapted varieties suited to organic production. A team of four artisan bakers developed a bake test protocol and tested varieties that had shown promising agronomic and quality characteristics. In a separate set of trials, promising winter wheat varieties were evaluated for their tolerance to late planting. One fertility trial compared different organic preplant nitrogen sources for their effects on spring wheat grain yield and protein concentration. Another trial evaluated the use of in-season diagnostic tests to determine if and how much topdress N is cost effective. Lastly, a systems trial compared rotations for organic bread wheat on dairy farms with particular attention to nitrogen and weed dynamics and grain yield and quality.

Results

This project is helping create local, organic food grain economies in our region. Field research projects provided new information that was implemented directly by farmers in our region. Three

years of variety trials have identified four to five new varieties each of spring and winter wheat that show promise in our region for organic production. Bakers identified certain varieties (e.g., Redeemer) that have superior baking quality. As a result, at least eight farmers in Maine, seven in Vermont, three in Quebec, one in New Hampshire, and four in New York have chosen new varieties based on this information. Since this project began, farmers in our region have increased production of organic wheat from 300 acres in 2008 to just under 1,700 acres in 2012, and they are well-positioned to meet further increases in demand. Farmers in Maine reported in a 2012 survey that as a result of this project they have made new contacts (80%) and changed at least one production or marketing practice (70%), which has helped them expand markets, improve crop/product quality, increase sales, increase yields, or reduce production costs. They estimated the economic value of these changes to be over \$10,000 each for those growing 10 or more acres of grain per year and over \$1,800 each for those growing less than 5 acres per year. Additionally, farmers and millers who participated in a 2010 "peer learning across borders" trip to Denmark estimated they will gain in sum more than \$400,000 in economic value from what they learned. The relationships made with Danish farmers, millers and bakers on that trip continue to develop.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #33

1. Outcome Measures

Enhance capacity of a sustainable global food system including new/improved plants, animals, technologies, and management systems--New potato varieties

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	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

As part of a multistate effort (NE1031), University of Maine scientists have taken part in a project to breed, select, and develop new potato varieties that will benefit potato producers in the eastern U.S. Crosses between parents with desirable traits take place at ME, NY, NC, and USDA Beltsville, MD. Field sites in ME, NY, NJ, PA, OH, VA, NC, and FL are used to test the breeding materials for yield and quality traits over a wide range of growing conditions.

Results

The eastern potato breeding and selection effort produces new varieties and evaluates their potential to serve fresh, processing, and specialty markets in the East. Red Maria was released in 2010 and two new chipping varieties, Lamoka and Waneta were released in 2011 and demand for their seed has exceeded supply. Elkton was released in 2012, while AF0338-17, AF3001-6, and AF3362-1 are likely to be released during 2013. These varieties and other promising clones from the project continue to be evaluated and adopted by the potato industry. Recent eastern releases since 2002 (e.g. Beacon Chipper, Marcy, Monticello, Harley Blackwell, Red Maria, Lehigh, and Peter Wilcox) were grown on 708 seed acres during 2011 with a seed value of \$1,880,000. The resulting seed crop had the potential to plant 7000 acres in 2012 with a ware value conservatively estimated at \$14M. Over a longer time frame, 26 of the 105 varieties listed in the ME certified potato directory were released by the Eastern programs since 1990. These releases represent 1909 seed acres with a seed value of \$5.1M. This seed crop had the potential to plant 19,000 acres in 2012 with a conservatively projected value of \$38,000,000. This excellent rate of adoption will certainly grow over time as the industry builds seed supplies. There is particularly strong grower interest in improved new chipping varieties to meet quality requirements of eastern processing plants. Harley Blackwell fits this need in NC and other eastern states where internal defects reduce the quality of the current standard chipping variety, Atlantic. Elkton and AF0338-17 are also expected to fit this market. Lamoka and Waneta are new chipping varieties that are being rapidly adopted by the industry. Marcy adoption has been strong because it chips, has scab resistance, and has 20% higher yield than standard varieties. Specialty varieties, Adirondack Blue, Adirondack Red, Lehigh and Peter Wilcox, are being adopted by small-scale fresh market growers because of their yellow, blue, or red flesh color and excellent culinary quality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants

Outcome #34

1. Outcome Measures

More sustainable, diverse, and resilient food systems in Maine

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Biological control of pests has a rich history in the USA with key successes dating back more than 125 years. University of Maine entomologists are participating in a northeast regional project that builds upon our national expertise in biological control and specifically addresses pest complexes and research opportunities that are unique to this region. Their work in Maine focuses on lowbush blueberry, a native perennial crop.

What has been done

UMaine entomologists have been studying the natural enemies of blueberry insect pest species to develop strategies for managing these pests that do not rely on insecticides as the predominant tactic. They have been studying the effectiveness of these natural enemies at suppressing pest insects and developing methods to ensure their conservation and integration into modern integrated pest management.

Results

Investigations into the native natural enemies of insect pests in the lowbush blueberry agroecosystem revealed that ants, spiders, opiliones, and ground beetles are the primary fauna represented. Of these groups, ants and spiders have the most impact on the abundance of pest insects. The researchers found that applications of organophosphate insecticides affect the diversity and abundances of the natural enemy species. By selecting reduced-risk insecticides, growers can limit deleterious effects on these valuable predators. They also found that ants appear to be negatively affected by herbicides, through a positive relationship between ant abundance and diversity and floral density within blueberry fields. The researchers recommend less intensive management and selection of less harsh insecticides as a tactic for enhancing natural biological control of insect pests in blueberry fields. The documented outcomes from this study include species establishment, natural enemy spread, reduced pest problems and associated effects on other components of the ecosystem as a result of natural enemy releases,

potential non-target effects, and increased knowledge about the science biological control. They shared these findings with blueberry growers at the annual University of Maine summer blueberry field day and during three grower twilight meetings held in the three major blueberry-growing regions in Maine.

4. Associated Knowledge Areas

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

Outcome #35

1. Outcome Measures

Maine blueberry farmers increase their knowledge of best practices for managing their crops

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Mummy berry disease affects all species of blueberry and can decrease yield up to 50% in highbush and 100% in lowbush blueberries. Currently, the majority of growers in Maine, New Hampshire, and Massachusetts are applying up to three fungicide applications using a calendar schedule which often results in incomplete control and unnecessary fungicide applications.

What has been done

University of Maine scientists are continuing to study the biology and control of mummy berry disease. They have conducted lab experiments to determine the range of sensitivity of *Monilinia vaccinii-corymbosi* to the most commonly used fungicides to control this fungus, propiconazole and fenbuconazole, and have conducted a fungicide field trial to test new fungicides for control of mummy berry disease. They have also set up field to determine if there are inherent differences in when the apothecia develop and the weather factors that affect apothecia development and longevity. In addition to their experiments, the researchers have spent made a concerted effort to educate growers on mummy berry disease. In 2012, they provided reports on mummy berry infection as blog posts, answering machine messages and email alerts from April 3 to May 18, and then subsequent posts on other diseases.

Results

Their research on *M. vaccinii-corymbosi* collected from three fields with multiple, bi-yearly applications of propiconazole found that these isolates were significantly less sensitive to propiconazole than isolates collected from a wild stand of lowbush blueberries that had never been treated with fungicides. These experiments suggest that there is the possibility of resistance to propiconazole developing in *M. vaccinii-corymbosi*. In fungicide trials in two fields, they found fungicides with different chemistries, different azole ingredients, and mixtures of fungicides were significantly effective at controlling mummy berry disease compared to an untreated control. In response to their educational efforts, the researchers have found that growers at field meetings answered questions about mummy berry disease correctly more than 75% of the time.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #36

1. Outcome Measures

Number of new diagnostic systems analyzing plant and animal pests and diseases

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Lobster mortality in shipment and live storage is becoming more of an economic problem. Shrinkage of more than 20% has been reported.

What has been done

To address issues related to lobster health and environmental interrelationships, University of Maine scientists formed the Lobster Shell Disease Coalition, a region-wide organization of scientists involved with lobster research.

Results

As part of the Lobster Health Coalition's efforts, a small number of lobsters were originally sampled from Maine with the help of funding from Maine Sea Grant. Then through the help of the NOAA funding, lobsters from Maine, Rhode Island, Massachusetts, and Long Island Sound were sampled. Shell lesions were recorded and measurements of other health parameters were taken. A total of 932 lobsters were examined. Lobsters were examined for vigor, parasites were noted, hemolymph was cultured and tissues were archived frozen in the University of Maine's Marine Environmental Samples Repository for future use. Histology was done on eye stalk, antennal gland, hepatopancreas, muscle, gonad, nerve, and shell. During the course of this Lobster Health Coalition project, the researchers also raised funds from a variety of sources to develop a Web site dedicated to communication among members of the LHC and between the LHC and industry, as well as the general public.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases

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

Some projects terminated early or PIs changed focus of their research, which affected our ability to report on all previously submitted state-defined outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluations are currently conducted at the project and program levels. At the project level, all projects are reviewed by an internal research council and external peer reviewers when initiated and again at completion by the research council. During the research council final evaluation, the focus is on determining if terminating projects met their stated objectives, secured extramural funding, and produced peer-reviewed publications. For FY12, 11 projects went through the review process in this program area. As for other measures of successful research programs, faculty in this program area published 42 peer-reviewed articles and secured more than \$2,700,000 in extramural funding. Also during this time period, research results published by faculty in this program area were cited by peers more than 900 times in other peer-reviewed journals.

Researchers use a variety of methods to evaluate their own research projects including evaluations retrospectively, before-after, and during the life of the project; case studies; and comparisons between treatment/intervention and nontreatment/nonintervention.

At the program level, external NIFA review teams are asked to review the research programs of schools/departments. These teams provide input on the impact and productivity of research programs supported through the station. The station is working to develop a standard program-level evaluation process, which will be used to evaluate each station program area. Our current plans include an approach based on use of expert panels as recommended by the federal Government Accounting Office with individual program evaluations occurring every four to five years on a staggered time table.

Key Items of Evaluation

Based on evaluations conducted during the project, researchers often revise or refocus their research efforts. For example in a study on wild blueberry production, investigators expanded project sites from two to four per management system for a total of 16 sites, but blocks per site were reduced from four to two, so total number of sample blocks remained the same at 32. This change enables the scientists to capture more variability to improve the application of the results. Researchers also respond to emerging concerns from industries to which their connected and change the focus of their research to address such concerns. For example, when contacted by an oyster grower facing an infestation of blister worm on his oyster farm, University of Maine marine scientists began to investigate the physiological tolerances of the worm in order to devise better treatments for the problem.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

Reporting on this Program

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			4%	
102	Soil, Plant, Water, Nutrient Relationships			9%	
112	Watershed Protection and Management			11%	
123	Management and Sustainability of Forest Resources			18%	
133	Pollution Prevention and Mitigation			4%	
135	Aquatic and Terrestrial Wildlife			7%	
136	Conservation of Biological Diversity			7%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			14%	
204	Plant Product Quality and Utility (Preharvest)			3%	
211	Insects, Mites, and Other Arthropods Affecting Plants			3%	
212	Pathogens and Nematodes Affecting Plants			3%	
213	Weeds Affecting Plants			3%	
605	Natural Resource and Environmental Economics			14%	
Total				100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.4	0.0
Actual Paid Professional	0.0	0.0	3.9	0.0
Actual Volunteer	0.0	0.0	0.0	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	222745	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	293309	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	318573	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct scientific research. Publish peer-reviewed journal articles and other publications. Present findings at professional and public meetings and at other venues. Educate undergraduate and graduate students.

2. Brief description of the target audience

Maine natural-resource-based industries, Cooperative Extension staff, other scientists, local, state, and federal policymakers, regulators, and legislators, land-conservation organizations, K-12 teachers, interested members of general public who are concerned about possible effects of climate change.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	8	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of other publications

Year	Actual
2012	4

Output #2

Output Measure

- Number of research projects completed

Year	Actual
2012	0

Output #3

Output Measure

- Number of professional or public presentations of research findings.

Year	Actual
2012	15

Output #4

Output Measure

- Number of annual population surveys of Floods Pond Arctic charr and obtained new samples for assessing Arctic charr diversity in Maine

Year	Actual
2012	1

Output #5

Output Measure

- Conducted sturgeon mark-recapture and telemetry study in Penobscot River and other rivers on Maine coast.

Year	Actual
2012	0

Output #6

Output Measure

- Co-hosted international conference BIOGEMON 2012, involving more than 200 scientists from 20 countries.

Year	Actual
2012	0

Output #7

Output Measure

- Several local library seminar series on changes in Maine forests. Attendance at the first three events ranged from 30 to more than 120.

Year	Actual
2012	0

Output #8

Output Measure

- Amount researchers in this program area received in extramural grants and contracts: \$536,379

Year	Actual
2012	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	improvements in federal, state, local and private institutional decision-making with respect to managing public and private lands by reducing risks associated with natural hazards such as fire, invasive species, weather-related natural events, and climate change
2	Use of new rootstocks that are better suited to Maine's climate for commercial apple production in Maine
3	Increased profitability for Maine apple growers based on their use of better-adapted rootstocks
4	Better understanding of the effects of climate change on Maine agriculture
5	Better understanding of the effects of climate change on Maine salmon
6	Number of biogeochemical indicators or metrics that have been mapped in Maine watersheds
7	Development of new knowledge on the response of forest soils to environmental alterations
8	Development of new knowledge and the transfer of this knowledge to clientele to address the effects of climate variability and change--Improve understanding of how perch traits rapidly respond to changing lake conditions and how perch trait variation in turn influences aquatic ecosystem conditions
9	Develop new knowledge on shortnose sturgeon wintering habitats

Outcome #1

1. Outcome Measures

improvements in federal, state, local and private institutional decision-making with respect to managing public and private lands by reducing risks associated with natural hazards such as fire, invasive species, weather-related natural events, and climate change

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Natural resource agencies and institutions at the federal, state, and local levels, as well as private landowners, attempt to balance economic growth and environmental quality. Emphasis on environmental quality is evident in provisions of the most recent Farm Bills; in agricultural land preservation programs at the local, state and federal levels; and in legislative mandates to federal agencies to justify their decisions regarding how natural resources are to be managed, including protecting environmental quality, providing wildlife habitat, and providing access for recreation. Federal, state, local, and private institutions face considerable challenges when making natural resource management decisions. Many of these decisions necessitate consideration of tradeoffs between economic growth and environmental quality. Furthermore, although private actions of households mediate the impacts of natural hazards, few households fully understand the risks they face and how their actions influence these risks and those faced by other members of the public. Moreover, institutional decision-makers charged with managing these risks do not fully understand how households make decisions.

What has been done

As part of a multistate project University of Maine economists collaborated with scientists in other states in a series of studies of voting behavior with regard to land protection programs, impacts of public lands on property values, urban-rural land use dynamics, and land use policies. The scientists also conducted applied economics research of invasive forest pest management issues in Maine, North Carolina, and Tennessee, which revealed complex management tradeoffs across private and public landscapes and public forest land management objectives. By conducting research on household decision-making in response to arsenic contamination of drinking water, invasive forest pests, and changes in surface water quality, this project improved knowledge of household behavior and disclosed opportunities for improved risk communication and targeted outreach and marketing to public agencies, communities, and private businesses.

Results

The results of this research offer guidance to promote changes in action by supporting the development of improved risk communication, prevention, and education programs. For example, Maine-based research on arsenic was shared with staff from Maine CDC and continued collaborations with these staff demonstrate the value of these findings. Research on management options for controlling invasive forest pests on public lands and public land management programs improved knowledge about key aspects of public preferences and emphasized the significance of spatial patterns in the benefits and costs of providing such services. These advances in knowledge can help citizens, policy-makers, and private businesses make informed decisions about land use and land management. Improved knowledge of connections between urban and rural places and the impacts of ecosystem services on these connections will help stakeholders also make more informed regional economic development and natural resource management decisions. For example, Maine-based research in this area was communicated to state and local land use planners through targeted workshops and stakeholder engagement processes, has supported policy efforts intended to revise wetland and land use regulations, and, in combination with results from other related projects, was featured in a public television program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics

Outcome #2

1. Outcome Measures

Use of new rootstocks that are better suited to Maine's climate for commercial apple production in Maine

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Increased profitability for Maine apple growers based on their use of better-adapted rootstocks

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Better understanding of the effects of climate change on Maine agriculture

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Better understanding of the effects of climate change on Maine salmon

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of biogeochemical indicators or metrics that have been mapped in Maine watersheds

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

River and stream ecosystems play a critical role in the Maine landscape as valuable habitats and fluvial connectors, linking upland watersheds with downstream aquatic and estuarine ecosystems through fluxes of water, matter, and energy. Increasingly, rivers and other aquatic ecosystems are facing pressures and threats associated with human population growth, climate changes, land development, invasive exotic species, and non-point pollution. Given these environmental uncertainties, there is a need for research aimed at sustaining and managing the ecological health of these ecosystems.

What has been done

University of Maine scientists examined watershed exports of carbon, nitrogen, phosphorus, major solutes, and suspended sediments during five water years in the Penobscot River basin, which forms part of the Gulf of Maine watershed.

Results

Mean annual exports of dissolved organic carbon (DOC) in the Penobscot River were 58 kg C ha⁻¹ year⁻¹, whereas cumulative yearly watershed flux of DOC during the study period ranged from 8.6 to 16.1 × 10¹⁰ g C year⁻¹ and averaged 11.7 × 10¹⁰ g C year⁻¹. Watershed exports of total soluble N (TN) and total soluble P in the Penobscot River averaged 1.9 and 0.02

kg ha(-1) year(-1), respectively. Extrapolation of results from this investigation and a previous study indicates that estuaries and coastal waters in the Gulf of Maine receive at least 1.0×10^{10} g N year(-1) and 2.5×10^{11} g C year(-1) in combined runoff from the four largest Maine river basins. Soluble exports of Ca + Mg + Na minus wet deposition inputs of cations in the Penobscot system were approximately 1,840 mol(c) ha(-1) year(-1), which represents a minimum estimate of cation denudation from the watershed. Based on its low N and P export rates, the Penobscot River watershed represents an example of reference conditions for use as a benchmark in ecological assessments of river water quality restoration or impairment. In addition, the biogeochemical metrics from this study provide an historical baseline for analysis of future trends in nutrient exports from the Penobscot watershed as a function of changing climatic and land use patterns. This research, in collaboration with an NSF-supported investigation of alternative landscape futures, is also providing a valuable interdisciplinary training opportunity for three doctoral students.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #7

1. Outcome Measures

Development of new knowledge on the response of forest soils to environmental alterations

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Studies of the way nutrients, carbon, water, and energy flows through forested ecosystems will enable us to better understand the underlying mechanisms that control the form and function of these ecosystems. This understanding is essential for us to be able to determine the effects of environmental perturbations at the global (e.g., climate change), continental (e.g., acid deposition), regional (e.g., biomass harvesting), and local (e.g., biosolids land spreading) scales. The ecosystem process research helps us to design better environmental monitoring systems, along with better predictive models to allow us to determine the future effects of the present and

emerging environmental stressors.

What has been done

University of Maine scientists are focusing on a long-term whole forested watershed study that provides insights unique to understanding the long-term response of forests and streams to a changing chemical and physical climate. In the past year, the long-term record of measurements has continued. Recent studies have shown that base cation depletion continues on both watersheds due to the treatment (on the treated watershed) as well as due to continuing declines in atmospheric deposition of sulfur and nitrogen as a result of the 1990 Clean Air Act Amendments. This past year has seen findings on the use of soil extracellular enzymes in determine nutrient limitations, particularly for phosphorus. We have completed a series of studies on in-stream nutrient stoichiometry, particularly for carbon, nitrogen, and phosphorus interactions.

Results

Results show clear and important contributions from in-stream processes for whole watershed nutrient export, and particularly for the importance of phosphorus in nitrogen dynamics. The scientists have also begun a major nitrogen study at the watersheds focusing on nitrogen dynamics after 23 years of whole watershed nitrogen enrichment. This includes the use of stable isotopes of nitrogen with this past year focusing on insights from delta15N natural abundances.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources

Outcome #8

1. Outcome Measures

Development of new knowledge and the transfer of this knowledge to clientele to address the effects of climate variability and change--Improve understanding of how perch traits rapidly respond to changing lake conditions and how perch trait variation in turn influences aquatic ecosystem conditions

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Humans are currently the world's most potent evolutionary agent, drastically reshaping the face of biodiversity in the wake of various forms of disturbance. Indeed, many of our current approaches to the management and conservation of natural resources can alter such genetic diversity for the better or worse. Although the preservation of locally adapted diversity is commonly cited as a central tenet of conservation biology and natural resource management, several factors still limit our ability to implement evolutionarily-informed monitoring and management practices: (1) population resources (genetic and phenotypic) are often poorly characterized, (2) a lack of quantitative insights into the role of evolutionary diversity in the fate of populations and function of ecosystems, and (3) a lack of guidance to managers and the public with respect to why or how genetic diversity and ongoing evolution should be incorporated in resource management.

What has been done

University of Maine scientists are conducting empirical research to assess potential reciprocal interactions between evolutionary diversity, ongoing evolutionary processes mediated by humans, and emergent ecological effects on aquatic populations, communities and ecosystems. They are also beginning to develop a synthetic eco-evolutionary framework to problems in ecology and conservation biology, by employing appropriate theory and model systems. Further efforts involve providing resource managers and the public with scientifically based insights into the evolutionary resources that exist in Maine's aquatic ecosystems and the potential consequences of various resource management decisions.

Results

Ongoing research on the white perch study system continues to reveal ways in which perch traits rapidly respond to changing lake conditions and that perch trait variation in turn influences aquatic ecosystem conditions. The scientists have expanded their trait considerations to fish stoichiometry (body elemental content) and excretion. Their analyses show that the body and excretion content of white perch varies with lake nutrient state. Subsequent simulation models show that such effects have the potential to influence overall excretion dynamics of fish populations and thus nutrient cycling in lakes. In combination these findings suggest that cultural eutrophication by humans could potentiate the emergence of important eco-evolutionary interactions.

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

Develop new knowledge on shortnose sturgeon wintering habitats

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Humans are currently the world's most potent evolutionary agent, drastically reshaping the face of biodiversity in the wake of various forms of disturbance. Indeed, many of our current approaches to the management and conservation of natural resources can alter such genetic diversity for the better or worse. Although the preservation of locally adapted diversity is commonly cited as a central tenet of conservation biology and natural resource management, several factors still limit our ability to implement evolutionarily-informed monitoring and management practices: (1) population resources (genetic and phenotypic) are often poorly characterized, (2) a lack of quantitative insights into the role of evolutionary diversity in the fate of populations and function of ecosystems, and (3) a lack of guidance to managers and the public with respect to why or how genetic diversity and ongoing evolution should be incorporated in resource management.

What has been done

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Results

Looking at shortnose sturgeon in the Penobscot River, the scientists have discovered that their wintering habitats are likely culturally inherited and that the overwintering site in the Penobscot has moved upstream by several kilometers in recent years. The scientists have also developed a new approach to estimating local sturgeon abundance using sonic-lens-imaging systems. These new findings that shortnose sturgeon have shifted their wintering habitat will result in new attention and protection for the critical habitat that now represents the wintering site.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Some projects terminated early or PIs changed focus of their research, which affected our ability to report on all previously submitted state-defined outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluations are currently conducted at the project and program levels. At the project level, all projects are reviewed by an internal research council and external peer reviewers when initiated and again at completion by the research council. During the research council final evaluation, the focus is on determining if terminating projects met their stated objectives, secured extramural funding, and produced peer-reviewed publications. For FY12, 11 projects went through the review process in this program area. As for other measures of successful research programs, faculty in this program area published 42 peer-reviewed articles and secured more than \$2,700,000 in extramural funding. Also during this time period, research results published by faculty in this program area were cited by peers more than 900 times in other peer-reviewed journals.

Researchers use a variety of methods to evaluate their own research projects including evaluations retrospectively, before-after, and during the life of the project; case studies; and comparisons between treatment/intervention and nontreatment/nonintervention.

At the program level, external NIFA review teams are asked to review the research programs of schools/departments. These teams provide input on the impact and productivity of research programs supported through the station. The station is working to develop a standard program-level evaluation process, which will be used to evaluate each station program area. Our current plans include an approach based on use of expert panels as recommended by the federal Government Accounting Office with individual program evaluations occurring every four to five years on a staggered time table.

Key Items of Evaluation

Although this program area has only 3.9 SYs, research articles written by these faculty

have been cited more than 900 times in other peer-reviewed journals this year.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Sustainable Energy

Reporting on this Program

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			38%	
201	Plant Genome, Genetics, and Genetic Mechanisms			19%	
206	Basic Plant Biology			6%	
402	Engineering Systems and Equipment			25%	
605	Natural Resource and Environmental Economics			5%	
609	Economic Theory and Methods			7%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.0	0.0
Actual Paid Professional	0.0	0.0	2.5	0.0
Actual Volunteer	0.0	0.0	0.0	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	84429	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	110571	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	125676	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct scientific research projects. Publish peer-reviewed journal articles and other publications. Present findings at professional and public meetings and at other venues. Educate undergraduate and graduate students.

2. Brief description of the target audience

Maine forest resources industry, other scientists, Cooperative Extension staff, state and federal policymakers, regulators, and legislators, classroom teachers

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	1	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of other publications
Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of research projects completed

Year	Actual
2012	4

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Develop in-process-line, real-time sensor components that incorporate NIRS information for process control and decision-making in woody biomass process stream
2	Development of products of value for use as bio-based fuel from the basic components of lignocellulosic materials
3	Novel wood adhesives containing the solid residues of biomass fermentation from biofuels/biochemical research that reduce or eliminate the use of petrochemical-based adhesive systems
4	Better understanding of synthetic photosynthesis as it relates to alternatives to biofuel production

Outcome #1

1. Outcome Measures

Develop in-process-line, real-time sensor components that incorporate NIRS information for process control and decision-making in woody biomass process stream

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Development of products of value for use as bio-based fuel from the basic components of lignocellulosic materials

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Novel wood adhesives containing the solid residues of biomass fermentation from biofuels/biochemical research that reduce or eliminate the use of petrochemical-based adhesive systems

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Better understanding of synthetic photosynthesis as it relates to alternatives to biofuel production

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Faculty for four ongoing projects in this program area left the University of Maine for positions at other universities, and their projects were terminated. There is currently one active project in this program area, which just started this past fall so there are no results yet.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Nothing to report.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Childhood Obesity

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
502	New and Improved Food Products			7%	
702	Requirements and Function of Nutrients and Other Food Components			20%	
703	Nutrition Education and Behavior			73%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.1	0.0
Actual Paid Professional	0.0	0.0	0.7	0.0
Actual Volunteer	0.0	0.0	0.0	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	45594	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	159216	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 scientific research projects. Publish peer-reviewed journal articles and other publications. Present findings at professional and public meetings and at other venues. Educate undergraduate and graduate students.

2. Brief description of the target audience

Other scientists, nutritionists, Cooperative Extension staff, state and federal policymakers, regulators, and legislators, classroom teachers, young adults

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	1	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of other publications

Year	Actual
2012	11

Output #2

Output Measure

- Number of completed research projects

Year	Actual
2012	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Better understanding of the usefulness of community based participatory research (CBPR) with a vulnerable population group--young adult college students,
2	Determine the usefulness of a new approach to preventing weight gain--the non-calorically restrictive, weight gain prevention intervention--with young adult college students
3	Improved weight-gain-prevention programs
4	Improve understanding of the role certain foods play human health

Outcome #1

1. Outcome Measures

Better understanding of the usefulness of community based participatory research (CBPR) with a vulnerable population group--young adult college students,

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Determine the usefulness of a new approach to preventing weight gain--the non-calorically restrictive, weight gain prevention intervention--with young adult college students

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Excessive weight gain is associated with increased risk of developing many serious diseases, including cardiovascular disease, hypertension, and type 2 diabetes. Young adults are at a uniquely increased risk for weight gain because of rapidly changing social situations that influence eating and exercise behaviors. Despite extensive efforts to promote weight management, these efforts only reach a small proportion of the population at risk and even effective programs promoting individual behavior change may have limited effectiveness in environments that promote weight gain.

What has been done

Maine led a multistate team in refining and testing the Campus Dining Environmental Audit Tool which will be part of the Healthy Campus Index tool, the focus of the five-year project NC1193. A serial process of testing and revising was used on the University of Maine campus during fall, 2011 and spring 2012. Information collected for each venue (i.e., student union, dining halls, grocery, pub, restaurant) included hours open and seating capacity of venues, number of healthy food options (e.g., no added sugar fruits, no added salt/fats vegetables; healthy cereals); signs encouraging healthful eating; and availability of nutrition information.

Results

There are no outputs/impacts for this first year of the study, but work is merging related to behavior and environmental supports for healthful behavior.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #3

1. Outcome Measures

Improved weight-gain-prevention programs

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Improve understanding of the role certain foods play human health

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Obesity and other diet-related chronic diseases are major health problems in Maine and the rest of the nation. A better understanding of the role certain foods play human health will enable nutritionists to convey that information to consumers, thereby helping people to make better nutritional choices.

What has been done

University of Maine scientists evaluated of the fate of bioactive components, particularly anthocyanins and phenolic acids, during food processing and storage. They also conducted a

study on the post-prandial effects of blueberries and blueberry and cranberry juices on appetite and serum glucose and insulin levels.

Results

Their studies showed that anthocyanins and phenolic acids in purple corn were relatively stable during extrusion cooking, but these compounds also formed new complexes. For wild blueberries, their research found that minimal use of agricultural inputs results in higher levels of these phytochemicals in wild blueberries, but led to lower levels of consumer acceptability. Their study on the post-prandial effects of anthocyanin-rich foods showed that neither wild blueberries nor wild blueberry juice significantly affected satiety in overweight adults compared to placebos. Consumption of beverages containing 25% and 54% cranberry juice did not influence satiety in overweight adults, but the more concentrated juice did reduce postprandial glucose. Anthocyanin-rich foods should be studied further to understand their effect on human glucose levels.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluations are currently conducted at the project and program levels. At the project level, all projects are reviewed by an internal research council and external peer reviewers when initiated and again at completion by the research council. During the research council final evaluation, the focus is on determining if terminating projects met their stated objectives, secured extramural funding, and produced peer-reviewed publications. For FY12, one project went through the review process in this program area. As for other measures of successful research programs, faculty in this program area published six peer-reviewed articles and secured more than \$18,000 in extramural funding. Also during this time period, research results published by faculty in this program area were cited by peers

more than 100 times in other peer-reviewed journals.

Researchers use a variety of methods to evaluate their own research projects including evaluations retrospectively, before-after, and during the life of the project; case studies; and comparisons between treatment/intervention and nontreatment/nonintervention.

At the program level, external NIFA review teams are asked to review the research programs of schools/departments. These teams provide input on the impact and productivity of research programs supported through the station. The station is working to develop a standard program-level evaluation process, which will be used to evaluate each station program area. Our current plans include an approach based on use of expert panels as recommended by the federal Government Accounting Office with individual program evaluations occurring every four to five years on a staggered time table.

Key Items of Evaluation

Although there are only 0.7 SYs in this program, peer-reviewed research published by these faculty was cited more than 100 times in peer-reviewed journals this year.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Food Safety

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
311	Animal Diseases			10%	
315	Animal Welfare/Well-Being and Protection			10%	
501	New and Improved Food Processing Technologies			8%	
603	Market Economics			4%	
607	Consumer Economics			4%	
701	Nutrient Composition of Food			10%	
703	Nutrition Education and Behavior			4%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			40%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.6	0.0
Actual Paid Professional	0.0	0.0	2.7	0.0
Actual Volunteer	0.0	0.0	0.0	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	230114	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	400569	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 scientific research. Publish peer-reviewed journal articles and other publications. Present findings at professional and public meetings and at other venues, and provide training sessions for food producers and processors. Educate undergraduate and graduate students.

2. Brief description of the target audience

Maine food producers and processors, Cooperative Extension staff, other scientists, state policymakers, regulators, and legislators, classroom teachers, consumers, and general public.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	1	10

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of other publications

Year	Actual
2012	17

Output #2

Output Measure

- Completed research projects

Year	Actual
2012	3

Output #3

Output Measure

- Number of presentations at scientific meetings/conferences

Year	Actual
2012	11

Output #4

Output Measure

- A prototheca workshop was given at the National Mastitis Council annual meeting during 2012

Year	Actual
2012	1

Output #5

Output Measure

- Amount researchers in this program area received in extramural grants and contracts: \$245,000

2012 University of Maine Research Annual Report of Accomplishments and Results

Year	Actual
2012	245000

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	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	Percentage of Maine food industry and food producers adopting new effective methods to eliminate microbial contaminations
3	Percentage of Maine food industry and food producers using ingredients with natural antimicrobial properties in food products to control foodborne pathogens
4	Safer food supply and protection against foodborne illness and bacterial infection for the people of Maine
5	Increased number of regional dairy farmers using an alternative teat dip
6	Reduction in use of disinfectant teat dips will increase level of human health
7	Increase number of viable technologies to improve food safety
8	Improve mastitis prevention/control efforts for Maine dairy farms

Outcome #1

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	Actual
2012	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 the behaviors of food safety agencies. For example, agencies may develop new marketing strategies or target different consumers.

What has been done

University of Maine economists have examined the effectiveness of Maine CDC's fish consumption advisory. The researchers administered a mail survey that collected data from pregnant women about their fish consumption. They used the resulting data to measure the effectiveness of Maine CDC's education strategy to convince pregnant and nursing women switch away from eating fish with high levels of mercury contamination to fish with low levels of contamination.

Results

The results of the survey study led CDC to redesign the advisory and for the researchers to re-examine the effectiveness of the advisory. The readers of the new advisory were more aware and knowledgeable of safe fish consumption, increased their consumption of low-mercury, high omega-3 pre-packaged salmon, decreased their consumption of high-mercury white tuna, and significantly, increased their consumption of low-mercury fish.

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 #2

1. Outcome Measures

Percentage of Maine food industry and food producers adopting new effective methods to eliminate microbial contaminations

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Percentage of Maine food industry and food producers using ingredients with natural antimicrobial properties in food products to control foodborne pathogens

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Safer food supply and protection against foodborne illness and bacterial infection for the people of Maine

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Consumption of fresh fruits and vegetables has increased in recent years. With an increase in consumption has come an increased frequency of foodborne outbreaks associated with raw or minimally processed fruits and vegetables. Bacterial foodborne outbreaks have been associated with fresh fruit and vegetable products including a recent Escherichia coli O157:H7 outbreak associated with spinach. Therefore, research is needed to better understand not only the mechanisms through which pathogens can contaminate fresh fruits and vegetables, but also the

procedures for eliminating pathogens once they are present, either on the surface or in internal tissues, and the analytical methods for pathogen detection.

What has been done

MAFES food scientists have established a simple predictive model based on the correlation of catalase activity and viable microbial counts for celery, bell pepper and ready-to-eat salad (lettuce) and have verified the model by random samples.

Results

The scientists found that the catalase activity in the sample is positively correlated to the log concentration of bacteria and fungi. The model based on the correlation between catalase activity and microbial loads was established and tested, with results that show accuracy of prediction at higher levels of contamination. The catalase assay is a simple, reliable, and rapid way of detecting concentration of total microorganisms in vegetables tested. It may have potential utility in a school cafeteria setting, or any other place with ready-to-eat foods.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #5

1. Outcome Measures

Increased number of regional dairy farmers using an alternative teat dip

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Reduction in use of disinfectant teat dips will increase level of human health

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Increase number of viable technologies to improve food safety

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There is a strong need for more efficient, more sensitive, and less expensive methods for analyzing both beneficial and toxic chemicals in our food and water.

What has been done

University of Maine researchers have used advanced analytical (chromatography) resources to support Maine agricultural, food processing, and biotech industries. Their continued long-term collaboration with Beacon Analytical Systems, a small Maine biotech company, has produced a number rapid analytical kits for the analysis of melamine (toxic adulterant) in various food matrices; Florfenicol (antibiotic) in lobster tissue; and capsaicinoids (natural pungent compounds) in hot pepper food products. Several years of work with Maine Medicinals, testing bioactive compounds in various elderberry cultivars and elderberry food products has helped establish a small elderberry agriculture presence in Maine, which should grow in importance over the next few years. The researchers have worked with the Maine Board of Pesticide Control to develop a better understanding of the fate and transport of pyrethroid and organophosphate pesticides in the environment.

Results

Their work with Beacon Analytical Systems in the area of melamine/cyanuric acid analysis, has helped the firm to continue to refine its rapid assay kit and has led to the creation of several well-paid scientific research jobs in Maine. The researchers' work with the elderberry growers has led to the production of several new foodstuffs that now enjoy a nationwide distribution. Knowledge gained from the fate of pesticide residues on blueberry fruit will lead to more effective insecticide application, while reducing potentially harmful residues.

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 #8

1. Outcome Measures

Improve mastitis prevention/control efforts for Maine dairy farms

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	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

University of Maine animal scientists have developed a nested PCR to screen bulk tank filters for prototheca, a colorless algae capable of causing bovine mastitis. This test was developed in their lab, and a statewide prototheca prevalence survey was completed using bulk tank filters from collaborating dairies. The PCR test has been used to screen dairies on a research and clinical basis in the mastitis lab. The scientists have also tested pasteurization resistance of Maine prototheca isolates, and evaluated bedding types for prevention of prototheca on farms.

Results

Implementation of a nested PCR for detection and speciation of prototheca from dairy farm samples has contributed to a change in knowledge by allowing sensitive and specific detection of prototheca in a herd of dairy cattle. The research has also shown that the use of cedar shavings as a bedding source minimizes prototheca transmission on the farm. The new screening ability has led one dairy farmer to change methods of water delivery, cleaning/sanitizing methods, and engage in repeated testing/culling to keep the disease under control. Rapid detection and prompt action should reduce the incidence of prototheca mastitis, improve milk quality, and decrease the cost of milk production for Maine dairy farms. As more information about the state and regional prevalence of protothecal mastitis is developed, the disease should decrease in incidence due to improved hygiene and culling of infected cattle.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluations are currently conducted at the project and program levels. At the project level, all projects are reviewed by an internal research council and external peer reviewers when initiated and again at completion by the research council. During the research council final evaluation, the focus is on determining if terminating projects met their stated objectives, secured extramural funding, and produced peer-reviewed publications. For FY12, two projects went through the review process in this program area. As for other measures of successful research programs, faculty in this program area published 10 peer-reviewed articles.

Researchers use a variety of methods to evaluate their own research projects including evaluations retrospectively, before-after, and during the life of the project; case studies; and comparisons between treatment/intervention and nontreatment/nonintervention.

At the program level, external NIFA review teams are asked to review the research programs of schools/departments. These teams provide input on the impact and productivity of research programs supported through the station. The station is working to develop a standard program-level evaluation process, which will be used to evaluate each station program area. Our current plans include an approach based on use of expert panels as recommended by the federal Government Accounting Office with individual program evaluations occurring every four to five years on a staggered time table.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Sustaining Natural Resources

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
111	Conservation and Efficient Use of Water			7%	
123	Management and Sustainability of Forest Resources			10%	
132	Weather and Climate			2%	
133	Pollution Prevention and Mitigation			2%	
134	Outdoor Recreation			8%	
135	Aquatic and Terrestrial Wildlife			43%	
136	Conservation of Biological Diversity			13%	
206	Basic Plant Biology			7%	
301	Reproductive Performance of Animals			2%	
306	Environmental Stress in Animals			4%	
723	Hazards to Human Health and Safety			2%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	5.4	0.0
Actual Paid Professional	0.0	0.0	6.9	0.0
Actual Volunteer	0.0	0.0	0.0	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	332717	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	610042	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	363425	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct scientific research. Publish peer-reviewed journal articles and other publications. Present findings at professional and public meetings and at other venues. Educate undergraduate and graduate students.

2. Brief description of the target audience

Other scientists; teachers at all levels; directors of aquariums and museums, exhibit halls, etc.; endangered species biologists/managers; policy makers; state regulatory agencies; environmental consultants

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	6	5

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of other types of publications

Year	Actual
2012	6

Output #2

Output Measure

- # of research projects completed

Year	Actual
2012	5

Output #3

Output Measure

- Faculty in this program area secured \$1,635,254 in extramural funding

Year	Actual
2012	1635254

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	# of streams identified as promising or critical candidates for native salmonine conservation, based on potential perturbation from invasive species and/or riparian zone management
2	# of natural resource managers or biologists incorporating research results on conservation of native fishes into official policy and management plans
3	Number of management agencies using empirical data and model systems to draft recommendation on fish management and conservation
4	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.
5	Recovery actions will be implemented to conserve the endemic Clayton's copper butterfly and its habitat
6	Increase in the distribution and abundance of migratory fish in Maine
7	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
8	# state and federal agencies applying knowledge of bird migration patterns in the Gulf of Maine in planning and permitting decisions related to off-shore wind development in state and federal waters
9	# regulatory agencies considering impacts of fishing activities and coastal/offshore energy development activities on seabird breeding and foraging as they relate to population regulation in the Gulf of Maine
10	Development, by state and federal agencies, of long-term resource management plans that use a "seasonal interactions" framework for songbird, shorebird, and seabirds in the region
11	Improve knowledge of, or strategies and tools for, protecting fish and wildlife habitat
12	Adoption of strategies for protecting fish and wildlife habitat

Outcome #1

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 #2

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Humans are currently the world's most potent evolutionary agent, drastically reshaping the face of biodiversity in the wake of various forms of disturbance. Indeed, many of our current approaches to the management and conservation of natural resources can alter such genetic diversity for the better or worse. Although the preservation of locally adapted diversity is commonly cited as a central tenet of conservation biology and natural resource management, several factors still limit our ability to implement evolutionarily-informed monitoring and management practices: (1) population resources (genetic and phenotypic) are often poorly characterized, (2) a lack of quantitative insights into the role of evolutionary diversity in the fate of populations and function of

ecosystems, and (3) a lack of guidance to managers and the public with respect to why or how genetic diversity and ongoing evolution should be incorporated in resource management.

What has been done

University of Maine scientists are conducting empirical research to assess potential reciprocal interactions between evolutionary diversity, ongoing evolutionary processes mediated by humans, and emergent ecological effects on aquatic populations, communities and ecosystems. They are also beginning to develop a synthetic eco-evolutionary framework to problems in ecology and conservation biology, by employing appropriate theory and model systems. Further efforts involve providing resource managers and the public with scientifically based insights into the evolutionary resources that exist in Maine's aquatic ecosystems and the potential consequences of various resource management decisions.

Results

Based on University of Maine research on the diversity of among Arctic charr populations in Maine, management agencies (MDIFW), local interest groups and NGOs (TU, The Nature Conservancy) are now emphasizing the importance of local populations in management of both healthy and imperiled populations in Maine. This research has led to an almost 180 degree change in perspective to one that greatly values local populations and their ecological significance. University scientists have provided evolutionarily informed reviews of fisheries management projects planned by MDIFW. Their comments in those cases have direct influences on the implementation of such projects.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #4

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 #5

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Increase in the distribution and abundance of migratory fish in Maine

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Native fishes of commercial, recreational, or ecological importance in Maine, such as Atlantic salmon, brook trout, alewife, and sea lamprey, have experienced range-wide decline because human activities have degraded freshwater habitats. Recently humans have sought to mitigate these negative impacts and restore native fisheries, especially for migratory species, by removing dams and restoring access to historic habitat. Both types of human impact can result in rapid changes to in-stream habitat, and it is vital to understand how native species respond and how their functional roles change so we can evaluate and adjust management objectives and actions accordingly. Much of Maine's economy and cultural identity is based upon restoring native fish species and their habitats while also providing angling opportunities for citizens and tourists.

What has been done

University of Maine ecologists have described and quantified changes in fish assemblage structure and function, and monitored demographics of sentinel species such as Atlantic salmon, sea lamprey, and alewife, in response to dam removal and restored habitat connectivity in small streams and large rivers.

Results

Their research showed distinct patterns in stream fish metrics over time and space due to the presence of a dam, and immediately after removal we saw drastic changes, including sea lamprey, juvenile ATS, and alewife recolonizing previously inaccessible habitat. Furthermore, they documented a four-fold increase in abundance of sea lamprey adults and showed that lamprey spawning alters physical habitat in the stream, and that other biota respond quickly. This study will help the scientists predict how other streams will respond to impending dam removal, and assist managers in future planning.

4. Associated Knowledge Areas

KA Code **Knowledge Area**
135 Aquatic and Terrestrial Wildlife

Outcome #7

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	Actual
2012	0

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.

What has been done

MAFES scientists conducted field studies from 2007-2011 to increase understanding of the distribution and density of eight Clayton's copper butterfly sub-populations in Maine. With the exception of Maine's largest occurrence, censuses to estimate site-specific population density had not previously been done. One subpopulation of Clayton's copper went extinct during the study. They also analyzed butterfly-host-plant habitat characteristics to address issues related to wetland habitat requirements at seven sites occupied by Clayton's copper butterfly.

Results

The researchers recommended a sampling approach for Clayton's copper butterfly to the Maine Department of Inland Fisheries & Wildlife, the agency responsible for conservation of this state endangered species. Estimates of Clayton's copper population density at eight of the nine known sites (one of which has apparently gone extinct) will aid state personnel in prioritizing sites for management. These results provide baseline information for future study of butterfly and host plant population dynamics at each site.

4. Associated Knowledge Areas

KA Code **Knowledge Area**

Outcome #8

1. Outcome Measures

state and federal agencies applying knowledge of bird migration patterns in the Gulf of Maine in planning and permitting decisions related to off-shore wind development in state and federal waters

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

USFSW and CWS

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
301	Reproductive Performance of Animals
306	Environmental Stress in Animals

Outcome #9

1. Outcome Measures

regulatory agencies considering impacts of fishing activities and coastal/offshore energy development activities on seabird breeding and foraging as they relate to population regulation in the Gulf of Maine

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

Development, by state and federal agencies, of long-term resource management plans that use a "seasonal interactions" framework for songbird, shorebird, and seabirds in the region

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A great many migratory bird populations that breed in New England have experienced dramatic declines over the past few decades. It is important to understand how migratory birds are affected by events occurring away from the breeding grounds along with the need for suitable breeding habitat so we can separate the direct effects of breeding habitat quality from carry-over effects set in place before birds arrive to breed.

What has been done

University of Maine scientists have focused on understanding the interaction among ecological, behavioral, and physiological factors as underlying mechanisms influencing how life history stage-specific responses can be carried over from one stage to the next. They have been examining plasma hormones, metabolites, immune function, and other measures of body condition in a variety of migrant and resident landbird and seabirds during different stages of the annual cycle. The researchers also use stable isotope signatures incorporated into tissues such as feathers, claws, and blood as biogeographic markers of where and when within the annual cycle individuals may be encountering challenges to their energy demand.

Results

The results of this project have led to an increased understanding of how migratory bird populations are regulated throughout the annual cycle, and how different stages of the annual cycle are not discreet and independent units. A series of laboratory and field studies has shown that stages of the annual cycle, often treated as discreet units and studied independently, have significant overlap, and that environmental factors can influence physiological mechanisms that manifest as seasonal interactions across the non-breeding, migration, and breeding periods. Maine's Department of Environmental Protection, Department of Conservation, and Department of Inland Fisheries and Wildlife, along with the U.S. Fish & Wildlife Service, are using this information to develop long-term resource management plans based on a seasonal interactions

framework for songbird, shorebird, and seabirds in the region.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
301	Reproductive Performance of Animals
306	Environmental Stress in Animals

Outcome #11

1. Outcome Measures

Improve knowledge of, or strategies and tools for, protecting fish and wildlife habitat

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

As Maine's forest landscape continues to change in response to economic and societal expectations, it has become critical for researchers and natural resource managers to have access to the most advanced information and technologies to plan for the future.

What has been done

University of Maine forest scientists have applied integrated data sets including time-series satellite imagery, GIS data, spatial modeling and statistics to address changing forest-cover composition and structure, recent insect defoliation events (gypsy moth), forest vulnerability to insect defoliation (spruce budworm), and disturbance rates and intensity in Maine forests and watersheds. An interdisciplinary team has integrated satellite-derived forest disturbance maps with aspatial Forest Inventory and Analysis (FIA) plot data to evaluate potential spruce budworm impact for a large northern forest study area.

Results

Using a version of the Spruce Budworm Decision Support System, researchers have successfully modeled the relative abundance of a suite of tree species groups required for landscape simulation using partial least squares regression, coupled with a genetic algorithm for optimal

selection of predictor variables. Preliminary results indicate that the relative abundance of budworm host species can be modeled with a high degree of accuracy which will greatly improve our ability to model budworm dynamics. Project results will be important to land managers and municipal planners in understanding and predicting changes in forest composition and land use and in working toward improved methods of forest resource assessment using appropriate remote sensing technology.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

Outcome #12

1. Outcome Measures

Adoption of strategies for protecting fish and wildlife habitat

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Commercial forest harvesting across the ~10 million acres of privately owned lands in northern, eastern, and western Maine exerts the greatest affect of all human activities on the habitat quality and population densities of resident vertebrates. Since the late 1990s, approximately 500,000 acres of commercial forestland have been harvested annually and forest management has increasingly come to rely on a variety of partial harvest treatments that result in a wide range of residual forest conditions. Since 1991 and the implementation of the Maine Forest Practices Act, harvested wood volumes have remained relatively stable, whereas the annual harvesting footprint has more than doubled and the annual acreage in partially harvested treatments has increased from approximately 50% to 96% of the area harvested.

What has been done

University of Maine wildlife ecologists have been evaluating the effects of current forest practices on a classic early successional species (i.e., snowshoe hares) and a classic mature and conifer-associated species (spruce grouse) and modeling the influences of those effects across the rapidly changing commercial forest landscapes of northern and western Maine.

Results

Their report titled "A landscape planning initiative for northern Maine using area-sensitive umbrella species" (July 2011) has been used as the foundation for a multi-species forest management plan implemented by The Nature Conservancy across 186,000 acres of northern Maine. This plan is being used as a prototype by several other large commercial forest landowners who are participating in a landscape planning initiative funded by the USDA's Healthy Forest Reserve Program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

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

Some projects terminated early or PIs changed focus of their research, which affected our ability to report on all previously submitted state-defined outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluations are currently conducted at the project and program levels. At the project level, all projects are reviewed by an internal research council and external peer reviewers when initiated and again at completion by the research council. During the research council final evaluation, the focus is on determining if terminating projects met their stated objectives, secured extramural funding, and produced peer-reviewed publications. For FY12, 5 projects went through the review process in this program area. As for other measures of successful research programs, faculty in this program area published 5 peer-reviewed articles and secured more than \$1,400,00 in extramural funding. Also during this time period, research results published by faculty in this program area were cited by peers more than 800 times in other peer-reviewed journals.

Researchers use a variety of methods to evaluate their own research projects including evaluations retrospectively, before-after, and during the life of the project; case studies; and comparisons between treatment/intervention and nontreatment/nonintervention.

At the program level, external NIFA review teams are asked to review the research programs of schools/departments. These teams provide input on the impact and productivity of research programs supported through the station. The station is working to develop a standard program-level evaluation process, which will be used to evaluate each station program area. Our current plans include an approach based on use of expert panels as recommended by the federal Government Accounting Office with individual program evaluations occurring every four to five years on a staggered time table.

Key Items of Evaluation

In a project involving citizen science and the role of social capital, trust and learning in solving groundwater quality and quantity issues UMaine scientists initially relied on informal project evaluations to measure success. For example, students, community volunteers and school teachers and administrators reported increased awareness of historic land use issues in the community in Rhode Island, Connecticut, New Hampshire, and Maine. As more data collection occurred, however, the researchers were able to formally evaluate outcomes and impacts. For example, they documented that 10% of parents who participated with their child in a 4-H GET WET! weekend tested their private well water within 6 months of the program. Both parent and child participants from the 4-H weekend indicated increased knowledge and level of concern related to groundwater issues. At the community level, their results showed increased resilience in groundwater communication networks, along with increases in community social networks in all five participating New England states. They also found that school-based community programs lead to stronger social networks. Study sites show interest in continuing the program after the end of the grant, which is a positive sign of sustainability.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Supporting Rural Economies

Reporting on this Program

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			4%	
111	Conservation and Efficient Use of Water			4%	
123	Management and Sustainability of Forest Resources			1%	
131	Alternative Uses of Land			8%	
134	Outdoor Recreation			14%	
136	Conservation of Biological Diversity			1%	
202	Plant Genetic Resources			4%	
205	Plant Management Systems			3%	
206	Basic Plant Biology			4%	
315	Animal Welfare/Well-Being and Protection			7%	
605	Natural Resource and Environmental Economics			18%	
608	Community Resource Planning and Development			24%	
723	Hazards to Human Health and Safety			8%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	4.4	0.0
Actual Paid Professional	0.0	0.0	5.6	0.0
Actual Volunteer	0.0	0.0	0.0	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	285140	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	381842	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	264504	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct scientific research. Publish peer-reviewed journal articles and other publications. Present findings at professional and public meetings and at other venues. Educate undergraduate and graduate students.

2. Brief description of the target audience

Scientists, economists, state and local policymakers, extension specialists, green/horticulture industry, tourism planners, land use commissions, and commercial fishermen

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2012	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: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	3	16

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research projects completed

Year	Actual
2012	5

Output #2

Output Measure

- Number of other publications

Year	Actual
2012	24

Output #3

Output Measure

- Faculty in this program area secured \$445,523 in extramural funding

Year	Actual
2012	445523

Output #4

Output Measure

- A prototype sensor-automated fog system for propagating cuttings

Year	Actual
2012	1

Output #5

Output Measure

- A survey comparing landowners who harvested trees in the last five years with and without the advice of a forester

Year	Actual
2012	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Use of information on occupational/agricultural chemicals by Maine state toxicologists and other regulators to make decisions about safe levels of exposure to toxicants in the workplace
2	Number of state agencies and regional tourism development groups that will use research results in planning types and locations of new nature-based tourism initiatives in the northern forest region
3	Better understanding among community leaders and citizens of the dynamics of labor markets and businesses and their effects on rural communities
4	Development of models that predict how plant water use is affected by the greenhouse environment.
5	Better understanding of the ability of the land base to support specific industries or recreation opportunities; the consequences of changing preferences on the remote and rural character of communities; and the design of management and policy tools in Maine's predominantly private landscape with multiple owners.
6	Maine growers will carry more "new" and unusual" plants for their production list and share their knowledge on these plants with their customers.
7	Maine growers will have new plants bred from Maine and increase their market-share locally, regionally, and national-wide.
8	Scientists, fishermen, and other stakeholders will adopt participatory approaches for producing and using knowledge for marine fisheries management
9	Adoption of strategies/tools for sustaining Maine's rural economies and communities
10	Improve knowledge of, or strategies and tools for, sustaining Maine's rural economies and communities

Outcome #1

1. Outcome Measures

Use of information on occupational/agricultural chemicals by Maine state toxicologists and other regulators to make decisions about safe levels of exposure to toxicants in the workplace

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Better understanding among community leaders and citizens of the dynamics of labor markets and businesses and their effects on rural communities

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

An understanding of attributes and forces that enhance or detract from community quality of life is important for guiding decision-making on policy.

What has been done

University of Maine economists, as part of multistate project NE1029, are attempting to increase knowledge about the forces affecting rural communities in terms of labor markets, industry, governance, and quality of life. Research conducted at the University of Maine focused on the following project objectives: identify and analyze ongoing and potential changes in rural labor

markets; investigate the potential for rural development policies based on entrepreneurship and industrial clustering; and investigate the effects of tax policy on economic growth in rural areas.

Results

After completing a Trade Area Analysis and Retail/Service Sector Gap Analysis for the City of Ellsworth, Maine, UMaine economists prepared reports and presented the results to more than 70 businessowners, economic development professionals, and policymakers who attended a Chamber of Commerce-sponsored event. The reports were posted to the Chamber's website and community officials indicated that they plan to incorporate results of the study in their upcoming economic development strategic plans.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #4

1. Outcome Measures

Development of models that predict how plant water use is affected by the greenhouse environment.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Better understanding of the ability of the land base to support specific industries or recreation opportunities; the consequences of changing preferences on the remote and rural character of communities; and the design of management and policy tools in Maine's predominantly private landscape with multiple owners.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Maine's forests are experiencing rapid change in ownership and land-use status as parcels are fragmented and residential development displaces traditional production-oriented land uses. Maine's forestlands are fundamental to the health and economic viability of the state's forest-based economic sectors, and also play a key role in the quality of life for many residents and visitors.

What has been done

University of Maine forest scientists have developed spatially explicit models to predict the likely location of new residential and commercial development within the state based on past and current patterns of land use. They have developed this capacity for the 2.5-million-acre Lower Penobscot River Watershed (LPRW), which drains roughly one-quarter of the state. Using Bayesian Belief Networks (BBNs) combined with geospatial data and expert opinion, they identified land suitability for forestry, agriculture, conservation and development. They then explored potential conflicts and compatibilities based on these land use suitabilities.

Results

This modeling of alternative scenarios for future growth has proven to be an effective way to improve understanding of existing land use and the intricate and dynamic connections between human and natural systems. The researchers have engaged stakeholders across a broad range of interests that includes conservation, government, business and real estate development. This breadth allows them to better understand the factors likely to drive future challenges and opportunities affecting Maine's landscape. The stakeholder-derived models of land suitability provide the public with quantitative, spatially explicit depictions that not only inform key stakeholders of current land use and suitability, but also allow various interests to design and evaluate the effects of alternative assumptions regarding population growth and development pressures on current and future landscapes. Most importantly, this modeling is designed to facilitate the identification of where compatibilities and conflicts in projected land use are likely to exist across time in response to differing assumptions embodied in future land use scenarios. The researchers believe that the proactive nature of this futures modeling approach is of great value to a wide range of stakeholders, allowing individuals, government and business to anticipate and avoid conflict, and in doing so help to achieve future landscape conditions that maximize social, ecological and economic benefits while reducing unnecessary costs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development

Outcome #6

1. Outcome Measures

Maine growers will carry more "new" and unusual" plants for their production list and share their knowledge on these plants with their customers.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Maine growers will have new plants bred from Maine and increase their market-share locally, regionally, and national-wide.

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Scientists, fishermen, and other stakeholders will adopt participatory approaches for producing and using knowledge for marine fisheries management

Not Reporting on this Outcome Measure

Outcome #9

1. Outcome Measures

Adoption of strategies/tools for sustaining Maine's rural economies and communities

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Human dimensions of natural resources have become a recognized component of management that is just as necessary as ecological study. As the state of Maine faces emerging issues such as increased development, growing motorized recreation use, and changes in supply and demand for forest resources, this research fills a critical need.

What has been done

University researchers conducted and analyzed forest social science survey, focus group, and interview data.

Results

This research on policy solutions to address issues of public access to private land influenced the successful passing of a Maine law, LD1613, "An Act to Strengthen the Relationships between Landowners and Land Users." The scientist directly presented the results to legislators and stakeholder groups who attended an open public meeting and this research was cited in legislative testimony during the comment period.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development

Outcome #10

1. Outcome Measures

Improve knowledge of, or strategies and tools for, sustaining Maine's rural economies and communities

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Maine and the nation suffer frequent strangles outbreaks in horses, with significant economic loss. Recently, carriers of the strangles organism have been shown to be detectable by endoscopy of the guttural pouch, and it is hypothesized that their isolation and treatment will reduce strangles incidence. Through development and dissemination of standard protocols for strangles surveillance, applicable not just in Maine, but the nation, University of Maine animal scientists anticipate that knowledge of how to eradicate the strangles organism will become more widespread.

What has been done

Using Maine as a testing ground, UMaine scientists are working to develop a model of strangles surveillance that could be applicable nationally and internationally towards eventual eradication of the disease worldwide.

Results

Confronted with two strangles outbreaks, the scientist started eradication programs. They have partnered with IDEXX Corporation to provide strangles diagnosis at no-cost to the client, through research funds. This has provided a platform for strangles surveillance, eradication, clinical studies, and field testing of diagnostic tests. The first of several endoscopes has been placed with a veterinarian to assist with strangles eradication. While there is still much work to be done, their efforts have led to a more coordinated approach to strangles surveillance in Maine, through the involvement of the assistant state veterinarian, and an increased understanding of strangles surveillance by veterinarians.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Some projects terminated early or PIs changed focus of their research, which affected our ability to report on all previously submitted state-defined outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluations are currently conducted at the project and program levels. At the project level, all projects are reviewed by an internal research council and external peer reviewers when initiated and again at completion by the research council. During the research council final evaluation, the focus is on determining if terminating projects met their stated objectives, secured extramural funding, and produced peer-reviewed publications. For FY12, five projects went through the review process in this program area. As for other measures of successful research programs, faculty in this program area published 16 peer-reviewed articles and secured more than \$1,300,000 in extramural funding. Also during this time period, research results published by faculty in this program area were cited by peers more than 200 times in other peer-reviewed journals.

Researchers use a variety of methods to evaluate their own research projects including evaluations retrospectively, before-after, and during the life of the project; case studies; and comparisons between treatment/intervention and

nontreatment/nonintervention.

At the program level, external NIFA review teams are asked to review the research programs of schools/departments. These teams provide input on the impact and productivity of research programs supported through the station. The station is working to develop a standard program-level evaluation process, which will be used to evaluate each station program area. Our current plans include an approach based on use of expert panels as recommended by the federal Government Accounting Office with individual program evaluations occurring every four to five years on a staggered time table.

Key Items of Evaluation