

2011 University of Maine Research Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Merit Review Process

The external scientific peer review process fully described in our 2000-2004 Plan of Work continues to be used to evaluate all MAFES projects, regardless of funding source. A total of 17 Hatch and McIntire-Stennis projects went through the process in FY2011.

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

Expenditure Summary

In our 2011 Plan of Work, the Maine Agricultural & Forest Experiment Station (MAFES) estimated 38.6 SYs for 2011; the actual number of SYs was 36.3 for FY2011. For FY2011 MAFES expended \$2,260,750 (Actual Formula Funds), \$3,843,794 (Actual Matching Funds), \$1,503,985 (Actual All Other Funds), for a total of \$7,608,529. This year for the first time, we are reporting 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 \$7,522,293 in grants and contracts in university fiscal year 2011 (July 1, 2010, through June 30, 2011).

Planned Programs

This is the first year that we are submitting the Annual Report of Accomplishments and Results based on the new program areas, including the five national program areas.

Global Food Security and Hunger

In our 2011 plan of work, we estimated that there would be 19.7 SYs in this program area; the actual amount of SYs allocated for 2011 was 12.4. During FY2011, MAFES expended \$968,810 (Hatch), and \$1,568,170 (1862 Matching), and \$0 (1862 All Other), for a total of \$2,536,980 in this program area; there were 39 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 FY2011, including

completed projects, patents, peer-reviewed and other publications, presentations at professional meetings, workshops, and other venues. Faculty working in this area brought in \$2,776,707 in extramural funding during university fiscal year 2011.

There were several outcomes in this program area during FY2011. To highlight a few: MAFES scientists have developed a biodegradable grow-out system for juvenile lobsters for use in open waters; MAFES researchers have increased awareness and knowledge of *Valdensinia* leaf spot throughout the blueberry growing areas of the state; MAFES aquaculturists successfully produced oyster seed for a series of lines with demonstrated resistance to disease.

Climate Change

In our 2011 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 2011 was 3.9. During FY2011, MAFES expended \$198,263 (Hatch), and \$291,974 (1862 Matching), \$392,144 (1862 All Other, includes M-S funds and their state match) for a total of \$882,381 in this program area; there were 8 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 FY2011, including completed projects, publications, and presentations at professional meetings, workshops, and other venues. Faculty working in this area brought in \$351,331 in extramural funding during university fiscal year 2011.

There were several outcomes in this program area during FY2011. To highlight a few: MAFES researchers educated Maine apple growers about cold-hardy, precocious rootstocks for apple and available rootstocks for plums; and scientists continued their long-term research on a whole forested watershed, which is providing insights unique to understanding the long-term response of forests and streams to a changing chemical and physical climate

Sustainable Energy

In our 2011 plan of work, we estimated that there would be 1.8 SYs in this program area; because we include McIntire-Stennis-funded projects in this report, the actual amount of SYs allocated for 2011 2.9. During FY2011, MAFES expended \$76,915 (Hatch), and \$215,133 (1862 Matching), \$358,526 (1862 All Other, includes M-S funds and their state match) for a total of \$650,575 in this program area; there were 7 research projects in this program area, falling under 6 knowledge areas.

MAFES research in this program area has resulted in a number of outputs for FY2011, including completed projects, peer-reviewed and other publications, and presentations at professional meetings, workshops, and other venues. Faculty working in this area brought in \$506,178 in extramural funding during university fiscal year 2011.

There were several outcomes in this program area during FY2011. As examples, in a project focused on bio-oil production from microalgae grown on low-cost lignocellulosic sugars, MAFES scientists improved collaboration across disciplines and institutions; and researchers developed statistical classification models to predict the chemical characteristics and processing quality of woody biomass.

Childhood Obesity

In our 2011 plan of work, we estimated that there would be 1.2 SYs in this program area; the actual amount of SYs allocated for 2011 was 1.2. During FY2011, MAFES expended \$69,742 (Hatch), \$131,450 (1862 Matching), and \$0 (1862 All Other) for a total of \$201,192 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 FY2011, including publications, presentations at professional meetings, workshops, and at other venues, and a study to assess the impact of dietary fiber content labeling in the sales of breads and wraps in the University of Maine Memorial Union dining facility. Faculty working in this area brought in \$18,469 in extramural funding during university fiscal year 2011.

A major outcome of this program area for FY2011 involves developing a successful and sustainable program for preventing excessive weight gain in young adults.

Food Safety

In our 2011 plan of work, we estimated that there would be 2.6 SYs in this program area; the actual amount of SYs expended for 2011 was 2.7. During FY2011, MAFES expended \$242,675 (Hatch), and \$448,040 (1862 Matching), \$0 (1862 All Other) for a total of \$690,715 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 FY2011, including publications, presentations at professional meetings, workshops, and other venues, and systems for detecting particular food pathogens.

There were several outcomes in this program area during FY2011. To highlight two: MAFES food scientists developed and tested cranberry marinades with antimicrobial properties, and developed a novel, simple, inexpensive, instrument-free gaseous ClO₂ approach for disinfection of fresh produce; MAFES animal scientists increased outreach and education efforts for mastitis prevention and control on Maine dairy farms.

Sustaining Maine's Natural Resources

In our 2011 plan of work, we estimated that there would be 5.0 SYs in this program area; because we include McIntire-Stennis funds in this report, the actual amount of SYs expended for 2011 was 7.0. During FY2011, MAFES expended \$368,456(Hatch), \$730,645(1862 Matching) and \$394,210 (1862 All Other, includes M-S funds and their state match) for a total of \$1,493,311 in this program area. There were 14 research projects in this program area, falling under 10 knowledge areas.

MAFES research in this program area has resulted in a number of outputs for FY2011, including completed projects, peer-reviewed and other publications, and presentations at professional meetings, workshops, and other venues. MAFES ecologists created a DVD on vernal pools in Maine. Faculty working in this area brought in \$1,444,178 in extramural funding during university fiscal year 2011.

There were several outcomes in this program area during FY2011. To highlight a couple: NOAA restoration biologists are using a MAFES project as a model for planned dam removal projects across the country; and MAFES biologists have developed novel tracking tools to be used on juvenile amphibians.

Support for Maine's Rural Communities

In our 2011 plan of work, we estimated that there would be 4.8 SYs in this program area; because we include McIntire-Stennis and Animal Health funds in this report, the actual amount of SYs expended for 2011 was 6.4. During FY2011, MAFES expended \$335,889(Hatch), \$458,382(1862 Matching) and \$359,105 (1862 All Other, includes M-S and AH funds and their state match) for a total of \$1,153,376 in this program area. There were 14 research projects in this program area, falling under 16 knowledge areas.

MAFES research in this program area has resulted in a number of outputs for FY2011, including completed projects, peer-reviewed and other publications, and presentations at professional meetings, workshops, and other venues. MAFES resource economists conducted 18 semi-structured interviews and 39 oral history interviews with fishermen from eastern Maine fishing communities. Faculty working in this area brought in \$1,378,997 in extramural funding during university fiscal year 2011.

There were several outcomes in this program area during FY2011. To highlight a couple: MAFES researchers have documented the dynamics of resource depletion in the Maine urchin fishery; MAFES scientists have improved coordination between native peoples, state, federal and university researchers, and other landowners to deal with the threat of the emerald ash borer.

Total Actual Amount of professional FTEs/SYs for this State

| Year: 2011 | Extension | | Research | |
|------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 38.6 | 0.0 |
| Actual | 0.0 | 0.0 | 36.3 | 0.0 |

II. Merit Review Process

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

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

2. Brief Explanation

The external scientific peer review process fully described in our 2000-2004 Plan of Work continues to be used to evaluate the scientific and societal significance of all proposed MAFES projects, regardless of funding source. A total of 17 Hatch and McIntire-Stennis projects went through the process in FY2011.

III. Stakeholder Input

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

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

Brief explanation.

The Maine Agricultural & 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 initiated a survey of research and extension needs of Maine agricultural organizations for the Board of Agriculture to be completed in FY13.

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.

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. Feedback from these committees provides information on research priorities and needs for these commodity groups.

The director and associate director discussed current research programs with legislators at two college exhibitions at the State House, one in association with the agricultural industry. The associate director of MAFES attended monthly meetings of the Agricultural Council of Maine as a way to maintain effective communication with the wide array of agricultural organizations in the state. These meetings provide MAFES administration with good information on issues important to Maine's agricultural community.

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

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

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

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.

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

1. Methods for collecting Stakeholder Input

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

Brief explanation.

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

3. A statement of how the input will be considered

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

Brief explanation.

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

Additionally, joint faculty positions are being filled and/or created in response to stakeholder

needs, including positions in ornamental horticulture and small woodlot management.

Brief Explanation of what you learned from your Stakeholders

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

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

The results of the Board of Agriculture survey of state agricultural organizations this year were used to identify current research and extension priorities for agricultural and horticultural groups across Maine and specifically to prioritize discipline areas for future position replacements.

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 | 2344822 | 0 |

| 2. Totaled Actual dollars from Planned Programs Inputs | | | | |
|---|--------------------------------|-----------------------|-----------------|--------------------|
| Extension | | | Research | |
| | Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| Actual Formula | 0 | 0 | 2260750 | 0 |
| Actual Matching | 0 | 0 | 3843794 | 0 |
| Actual All Other | 0 | 0 | 1503985 | 0 |
| Total Actual Expended | 0 | 0 | 7608529 | 0 |

| 3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous | | | | |
|--|---|---|------|---|
| Carryover | 0 | 0 | 7098 | 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 Maine's Natural Resources |
| 7 | Support for Maine's Rural Economy |

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

Global Food Security and Hunger

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 | | | 15% | |
| 202 | Plant Genetic Resources | | | 3% | |
| 204 | Plant Product Quality and Utility (Preharvest) | | | 4% | |
| 205 | Plant Management Systems | | | 11% | |
| 211 | Insects, Mites, and Other Arthropods Affecting Plants | | | 8% | |
| 212 | Pathogens and Nematodes Affecting Plants | | | 7% | |
| 213 | Weeds Affecting Plants | | | 8% | |
| 214 | Vertebrates, Mollusks, and Other Pests Affecting Plants | | | 1% | |
| 215 | Biological Control of Pests Affecting Plants | | | 1% | |
| 216 | Integrated Pest Management Systems | | | 5% | |
| 301 | Reproductive Performance of Animals | | | 5% | |
| 302 | Nutrient Utilization in Animals | | | 4% | |
| 303 | Genetic Improvement of Animals | | | 1% | |
| 311 | Animal Diseases | | | 16% | |
| 501 | New and Improved Food Processing Technologies | | | 3% | |
| 502 | New and Improved Food Products | | | 1% | |
| 601 | Economics of Agricultural Production and Farm Management | | | 2% | |
| 606 | International Trade and Development | | | 1% | |
| 702 | Requirements and Function of Nutrients and Other Food Components | | | 3% | |
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources | | | 1% | |
| | Total | | | 100% | |

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

| Year: 2011 | Extension | | Research | |
|--------------------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 19.7 | 0.0 |
| Actual Paid Professional | 0.0 | 0.0 | 12.4 | 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 | 968810 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 1568170 | 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

| 2011 | 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: 2011
 Actual: 1

Patents listed

The new treatment method for sea lice that was reported last year is now under consideration for commercialization with Pfizer Inc. and the University of Maine holds a provisional patent for this technology.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2011 | Extension | Research | Total |
|--------|-----------|----------|-------|
| Actual | 0 | 24 | 24 |

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 research projects completed

| Year | Actual |
|------|--------|
| 2011 | 9 |

Output #4

Output Measure

- Number of other, non-peer-reviewed publications

| Year | Actual |
|------|--------|
| 2011 | 24 |

Output #5

Output Measure

- Number of professional presentations

| Year | Actual |
|-------------|---------------|
| 2011 | 43 |

Output #6

Output Measure

- \$ amount of extramural funding received by faculty in this program area in FY2011

| Year | Actual |
|-------------|---------------|
| 2011 | 2776707 |

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|--|
| 1 | Decrease in percentage of lowbush blueberry leaf tissue samples with nitrogen and phosphorus deficiencies |
| 2 | Percentage of Maine lowbush blueberry growers surveyed who are changing their fertilization practices due to information provided by the fertility research program |
| 3 | Number of Maine vegetable and/or grain producers increasing their knowledge of biologically based nutrient sources and how to manage them |
| 4 | 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 |
| 5 | Development of a basic vaccine against the emerging fish pathogen <i>Francisella philomiragia</i> subsp. <i>noatunensis</i> |
| 6 | Development of best husbandry practices for polyculture fish farms |
| 7 | Maine aquaculturists use "new" feeds with lower fishmeal content to grow juvenile cod and halibut |
| 8 | Use of formulated feeds to grow juvenile sea urchins |
| 9 | Number of dairy producers modifying their forage management procedures by including the use of a silage additive |
| 10 | Increase in number of organic potato growers using biocontrol and mutualistic microorganisms to improve disease management, enhance crop yields, and increase soil fertility |
| 11 | Number of wild blueberry acres in Maine being treated with control measures for leaf drop diseases |
| 12 | More potato breeders will start using transgenic lines carrying novel R-genes from <i>S. bulbocastanum</i> as donors in their variety development programs |
| 13 | Release of at least one new eastern oyster broodstock to the oyster culture industry |
| 14 | Increase production efficiency and market share for Maine's oyster growers |
| 15 | Increase in number of crustacean processors in Maine producing/selling mince |
| 16 | Savings for aquaculture industry from development of effective vaccine regimens for Infectious Pancreatic Necrosis Virus and other infectious diseases of marine aquaculture species |
| 17 | Increased production of wild blueberries through proper management of weeds, diseases, and insect pests |

| | |
|----|---|
| 18 | 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 |
| 19 | Percentage decline in use of nutrient amendments that pose a net-negative impact on soil or water systems in Maine |
| 20 | Number of Maine vegetable growers practicing crop rotation in hoop houses by growing alternative crops |
| 21 | Percentage of Maine potato producers adding organic amendments to improve soil quality |
| 22 | # of commercial-scale tests of new high-yielding, high-quality, and/or pest-resistant potato clones tested in Maine |
| 23 | # of new high-yielding, high-quality, and/or pest-resistant potato clones named and released by the Maine Potato Breeding Program |
| 24 | Reduced pesticide use and/or improved marketable yields on acres planted to new pest-resistant potato cultivars in Maine |
| 25 | Test/develop new, high-yielding, high-quality, and/or pest resistant crops, livestock, and brood stock for Maine farmers and aquaculturists |
| 26 | Maine blueberry growers adopt new practices based on experiment station research |
| 27 | Improve knowledge/tools for fighting plant and animal diseases |
| 28 | Increase adoption of the Mummy Berry Forecast Method |
| 29 | Enhance capacity of a sustainable global food system through new/improved technologies and management systems |

Outcome #1

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #2

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 #3

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #4

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 #5

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Development of best husbandry practices for polyculture fish farms

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Maine aquaculturists use "new" feeds with lower fishmeal content to grow juvenile cod and halibut

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Use of formulated feeds to grow juvenile sea urchins

Not Reporting on this Outcome Measure

Outcome #9

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 #10

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 #11

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Leaf spots that cause early leaf drop are of great concern for growers since leaf drop may decrease flower bud production and yield. For lowbush blueberry growers in Maine, a high priority is the determination of the effects of leaf spot diseases on yield and the development of control strategies for these damaging diseases.

What has been done

MAFES scientists used fungicide efficacy trials to determine the importance of specific leaf spot diseases by determining the effect of controlling the disease on yield compared to untreated controls. They also investigated methods for eradicating *Valdensinia* leaf spot disease, which recently appeared in some Maine blueberry fields.

Results

The researchers found that powdery mildew and leaf rust occur mainly on plants in the prune year and while causing leaf drop do not significantly affect yield in the next year's crop. *Septoria* leaf spot, however, affects both prune and crop fields, but only control of this disease in crop fields had an effect upon yield. From 2009, *Valdensinia* leaf spot, which can cause complete defoliation of heavily infected plants, has been found in Maine in 17 commercial blueberry fields and 6 lowbush or highbush blueberry plantings. Grower meetings have educated growers about the differences between *Septoria*, "false *Valdensinia*" and *Valdensinia* leaf spots and their control measures. There has been an increase in the awareness and knowledge of *Valdensinia* leaf spot throughout the blueberry growing areas of the state. Due to the identification of *Valdensinia* leaf spot, growers became more aware of the disease and its effects on lowbush blueberry. Researchers and some blueberry growers are enacting methods to limit the spread of this disease by screening for contamination of equipment and personnel before moving between fields.

4. Associated Knowledge Areas

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

Outcome #12

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 #13

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2011 | 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, *C. virginica*, was worth in excess of \$1.4 million with >3 million oysters harvested, representing a 67% increase over the 2005 harvest. However, outbreaks of disease still cause considerable damage to the industry and limit its expansion. The impact of disease has been partially alleviated through improved husbandry and genetic improvement programs.

What has been done

During the reporting period, MAFES scientists successfully produced oyster seed for a series of lines with demonstrated resistance to MSX (Multinucleated Sphere Unknown) disease is caused by a single-celled Protozoan parasite, *Haplosporidium nelsoni*, Dermo (common name for an oyster disease caused by the protozoan parasite *Perkinsus marinus*), and Roseovarius oyster disease (ROD) as well as seed for hybrid lines generated by crossing the disease resistant lines.

Results

Seed oysters were deployed at 6 sites in New England in late July and August of this year and scientists are presently monitoring the growth and survival at each location. Although early in the project, to this point the scientists have already noted an outbreak of ROD at one test site in Maine and line-specific mortality associated with this outbreak.

4. Associated Knowledge Areas

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

Outcome #14

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #15

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #16

1. Outcome Measures

Savings for aquaculture industry from development of effective vaccine regimens for Infectious Pancreatic Necrosis Virus and other infectious diseases of marine aquaculture species

Not Reporting on this Outcome Measure

Outcome #17

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #18

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 Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Soil quality is recognized as a key yield limiting factor for wild blueberries.

What has been done

MAFES researchers initiated a four-year trial in 2010 to compare five fertility treatments (a locally-produced seafood compost, a bagged organic fertilizer (ProHolly), two rate of synthetic fertilizer (diammonium phosphate, DAP), and a no fertilizer control) on soil characteristics, nutrient dynamics, blueberry productivity, and fruit quality. These treatments were applied with and without mulch, as a second experimental factor.

Results

The studies indicate that, for organic wild blueberry growers, compost may be an economical alternative to the expensive bagged organic fertilizers they currently use. Total and edible berry yields increased on average by 70% over the no fertilizer control for all the fertility treatments (compost, bagged organic fertilizer, and diammonium phosphate), while there were no differences in yields among them. Soil pH increased from 4.6 to 4.9 due to the seafood-based compost. Alternative feedstocks should be considered for compost for wild blueberry production. Mulch increase plant tissue nitrogen and boron concentrations, but had no effect on yield. Results from this trial were presented to the Maine Wild Blueberry Commission at their annual meeting.

4. Associated Knowledge Areas

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

Outcome #19

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 #20

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 #21

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #22

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 |
|-------------|---------------|
| 2011 | 15 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Maine coordinated 15 commercial-scale trials representing 12 new potato varieties (5 chippers, 2 russets, 3 reds, 1 late blight resistant round white, and 1 specialty market yellow fleshed) and 116 acres during 2011.

Results

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 #23

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 |
|------|--------|
| 2011 | 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

Six advanced clones from the Maine potato breeding program were entered into commercial evaluations during 2010 and 2011. AF2291-10 is an early blight and scab resistant clone with good chipping quality. AF2574-1 is a fresh market clone with good yields and late blight resistance. AF0338-17 is a round-white that is widely adapted to eastern growing conditions and can chip from the field. AF3001-6, AF3362-1, and AF3317-15 are being evaluated as dual-purpose clones for French-fry processing and fresh market. The latter has very good late blight, scab, and pink rot resistance.

Results

Results to date indicate that all six AF clones listed are worthy of continued seed multiplication and commercial development for their respective markets. All six are in disease-free tissue culture

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

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 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 #24

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Late-blight-resistant varieties have the potential to reduce the reliance on foliar fungicides in potato production systems.

What has been done

MAFES scientists conducted a field study during 2011 to compare the performance of a late-blight-susceptible variety to three moderately resistant varieties. A standard fungicide program (13 applications) was compared to a reduced fungicide program (8 applications).

Results

Foliar late blight incidence was significantly lower in the resistant varieties, particularly in the reduced fungicide program. Yield and US1 yield differed among varieties, but not between management systems and no significant yield interaction was observed between varieties and

management systems. Rot incidence differed among varieties and was numerically, but not significantly higher, in the reduced fungicide program. This project is generating information to help determine whether resistant varieties can effectively be used to decrease foliar fungicide use while allowing growers to maintain tuber yields and quality.

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 #25

1. Outcome Measures

Test/develop new, high-yielding, high-quality, and/or pest resistant crops, livestock, and brood stock for Maine farmers and aquaculturists

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Maine vegetable growers face several challenges to economically viable vegetable production, not least of which is Maine's short growing season. Vegetable growers are also confronted with declining numbers of vegetable varieties developed for short cool growing seasons.

What has been done

MAFES researchers are working to develop practical solutions to economically viable vegetable production in Maine by identify vegetable varieties suitable for production in the region and through development and refining cultural management practices. They conducted multiple field and hoop house experiments focused on vegetable production and cultivar evaluation during the past year.

Results

Their evaluation of slicing cucumber cultivars found that Rockingham, Talladega and Cobra were the top-yielding cultivars, producing high yields and few culls. These gynocious cultivars produced highly acceptable 7-9 inch long, dark green fruit. Rockingham, Talladega and Cobra produced yields greater than the recognized standards Speedway and Raider. Seven small pie pumpkin cultivars (Chucky, Small Sugar, Field Trip, Mystic Plus, Fall Splendor, Baby Pam, Winter Luxury) were evaluated in a randomized complete block trial with three replications. These cultivars range in size from 4 to 10 pounds and are suitable for table decorations, face painting, and culinary use.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--------------------------|
| 205 | Plant Management Systems |

Outcome #26

1. Outcome Measures

Maine blueberry growers adopt new practices based on experiment station research

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

One of the largest production costs in lowbush blueberry is pollination. Maine blueberry growers currently rent more than 75,000 honey bee colonies each year. Blueberry growers are concerned that the current supply of colonies may not continue. While finding ways to control colony collapse disorder, developing or refining the use of additional pollinators is another approach to providing stability to growers dependent upon insect-mediated pollination.

What has been done

MAFES entomologists have been examining the use of commercial bumble bees in Maine's lowbush blueberry agroecosystem and sharing what they are learning with Maine blueberry growers.

Results

According to the researchers, blueberry growers continue to increase their adoption of bumble bees for pollination. A 9% increase in the use of bumble bee colonies was seen in 2011. However, as they become more accustomed to using bumble bees, more growers voice their concerns about quality control, meaning that several growers felt that within their complement of bumble bee colonies, several colonies showed little to no flight activity during bloom. To enhance flight activity, 2011 research results suggest that growers prevent bumble bee colony access to the sugar syrup that is supplied with the colonies by the bee-rearing company. Through a series of talks at twilight meetings in growers fields and a field day at the University of Maine's Blueberry Hill Farm, MAFS scientists explained how to manage bumble bees for pollination in lowbush blueberry and their potential to transmit mummy berry disease.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--------------------------|
| 205 | Plant Management Systems |

Outcome #27

1. Outcome Measures

Improve knowledge/tools for fighting plant and animal diseases

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Honey bees provide essential pollination services to US fruit and vegetable growers, adding \$8-10 billion annually to farm income. About 2 million colonies are rented by growers each year to service over 50 crops. Increasing demand comes at a time when beekeepers are operating in crisis mode. The supply of healthy colonies is volatile as parasitic mites and the rigors of migratory beekeeping continue to cause catastrophic die-offs. Pesticide resistance and a lack of viable, industry-based honey bee breeding programs contribute to these losses.

What has been done

As part of multistate project NC1173, MAFES entomologists investigated potential factors involved in honey bee colony collapse.

Results

MAFES research showed that honey bee exposure to the fungicide propaconazole had little impact on the colony health of honey bees. Analysis of the CAPS stationary hive project suggests that, after two years of the four-year project, colony collapse is a result of Varroa mite infestation along with Nosema ceranae infection and IAPV virus infection. However, there was a large site effect and interaction with these parasites and pathogens. It was found that possible explanations for the site effects were hot daily maximum temperatures at apiaries in the southern U.S., sublethal pesticide exposure in pollen collected while foraging affecting queen supercedure rates, and the amount of agricultural land area surrounding a given apiary site within a 2 mile radius.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|-----------------|
| 311 | Animal Diseases |

Outcome #28

1. Outcome Measures

Increase adoption of the Mummy Berry Forecast Method

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 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 3 fungicide applications using a calendar schedule which often results in incomplete control and unnecessary fungicide applications. The adoption of a mummy berry disease forecasting model (MBFM) will produce science-based pest management that safeguards human health and the environment and promotes economic benefits for growers.

What has been done

MAFES scientists set up leaf wetness and air temperature monitors and plots of mummy berries in blueberry-growing areas each year. These data were used to provide disease-risk forecasts

that were made available via telephone, internet blog, and email list. Growers were surveyed to determine their use of fungicides and adoption of the MBFM. The researchers also set up field experiments to compare the effectiveness of the MBFM over calendar-based timing of fungicide applications.

Results

The researchers found that two applications of fungicide following the MBFM achieved the same level of control of mummy berry blight as the three applications necessary to cover the same period using the calendar method. Yields in fungicide-treated plots were significantly higher than in untreated controls. Reporting these experiments to growers has resulted in an improved opinion of the MBFM. In 2010, many growers relied on forecasting reports to determine when to apply fungicides and many growers believed they had improved control of mummy berry blight. Surveys of growers in March 2011 found 65% of 139 survey respondents had heard of the forecast method and 72% used fungicides to control mummy berry. Of the 73 growers who answered the question, 86% follow the recommendations of the forecast method at least sometimes and 60% said it affected how they applied fungicide. Ninety-five percent of respondents wanted the MBFM to continue. In fall 2011, four companies that manage large acreage of fields and 6 small growers established mummy-berry-monitoring plots in their fields. This support led the Wild Blueberry Commission of Maine to apply for, and receive, Block Grant funding for more reliable weather stations and further studies on mummy berry control methods.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 216 | Integrated Pest Management Systems |
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources |

Outcome #29

1. Outcome Measures

Enhance capacity of a sustainable global food system through new/improved technologies and management systems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Seeding lobster larvae with minimal mortality can increase the local lobster harvest. But laboratory culture is costly and has high associated mortality.

What has been done

MAFES scientists developed a biodegradable grow-out system for open water use. The system aims to use perforated clam shells to grow newly hatched and early stage larvae giving them access to plankton to feed on rather than growing feed in the laboratory. This hatchery study is being field tested for future application.

Results

This system offered protection from predators and cannibalism and reduces the cost of lobster larval rearing by relying on natural feed rather than a supplement. These results have been communicated at lobster industry meeting such as the Massachusetts lobstermen's annual meeting, U.S./Canada lobster fishermen's town meeting, lobster bulletin and lobster institute web site.

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

Several projects were terminated as faculty retired or left the university.

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 FY11, seven projects went through the review process in this

program area. As for other measures of successful research programs, faculty in this program area published 24 peer-reviewed articles, submitted one patent, and secured \$2,776,707 in extramural funding. Furthermore, in FY11 research published by faculty in this program area was cited by peers more than 400 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. Within this program area, researchers involved in a project on controlling mummy berry disease in blueberries surveyed growers to evaluate how their efforts to educate growers were working,

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

The survey of blueberry growers found that 95 percent of respondents wanted the Mummy Berry Forecast Method (MBFM) to continue. In fall 2011, four companies, that manage large acreage of fields, and 6 small growers established mummy berry monitoring plots in their fields. This support for the MBFM led the Wild Blueberry Commission of Maine to apply for Block Grant funding through the state of Maine for funds to purchase, set up and monitor more reliable weather stations and further studies on mummy berry control methods. This grant was funded at \$79,354 in October 2011.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

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 | | | 7% | |
| 112 | Watershed Protection and Management | | | 11% | |
| 123 | Management and Sustainability of Forest Resources | | | 32% | |
| 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% | |
| 605 | Natural Resource and Environmental Economics | | | 14% | |
| | Total | | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2011 | 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 | 198263 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 291974 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 392144 | 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, 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

| 2011 | 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: 2011
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2011 | Extension | Research | Total |
|--------|-----------|----------|-------|
| Actual | 0 | 9 | 9 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of other publications

| Year | Actual |
|------|--------|
| 2011 | 2 |

Output #2

Output Measure

- Number of research projects completed

| Year | Actual |
|------|--------|
| 2011 | 1 |

Output #3

Output Measure

- Number of professional presentations

| Year | Actual |
|------|--------|
| 2011 | 13 |

Output #4

Output Measure

- Annual population survey of Floods Pond Arctic charr

| Year | Actual |
|------|--------|
| 2011 | 1 |

Output #5

Output Measure

- Assisted Maine Department of Inland Fisheries and Wildlife in implementing a recovery program for a threatened population of Arctic charr

| Year | Actual |
|------|--------|
|------|--------|

2011 0

Output #6

Output Measure

- Individual rootstock related consulting with apple growers

| Year | Actual |
|-------------|---------------|
| 2011 | 20 |

Output #7

Output Measure

- \$ amount of extramural funding received by faculty in this program area in FY2011

| Year | Actual |
|-------------|---------------|
| 2011 | 351331 |

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 and the transfer of these to clientele to address the effects of climate variability and change |

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

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Maine's apple industry requires highly adapted and productive rootstocks to maintain competitiveness in a global market. Growers need up-to-date information to make appropriate choices of rootstocks for their orchards because the appropriate selection of rootstock can have a large impact on profitability. New rootstocks, recently released from breeding programs, require testing to determine adaptability to Maine's climate and productivity.

What has been done

MAFES scientists continued their evaluation of rootstocks as part of multistate project NC-140.

Results

Maine apple growers learned about cold hardy, precocious rootstocks for apple and available rootstocks for plums. Rootstocks B.9, G.11, G.30 are being planted to replace M.9 and M.26 where cold hardiness and disease susceptibility are a concern..

4. Associated Knowledge Areas

KA Code **Knowledge Area**
203 Plant Biological Efficiency and Abiotic Stresses Affecting Plants

Outcome #3

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Maine's apple industry requires highly adapted and productive rootstocks to maintain competitiveness in a global market. Growers need up-to-date information to make appropriate choices of rootstocks for their orchards because the appropriate selection of rootstock can have a large impact on profitability. New rootstocks, recently released from breeding programs, require testing to determine adaptability to Maine's climate and productivity.

What has been done

MAFES scientists continued their evaluation of rootstocks as part of multistate project NC-140.

Results

Results from NC-140 research continue to direct the commercialization of tree fruit rootstocks. Changes in rootstock use by the industry are evident. Each year in the U.S., at least 12 million apple trees are planted and 92% of these are now on dwarfing rootstocks. The value of increased production from using dwarfing rootstocks is estimated to be \$500 million.

4. Associated Knowledge Areas

KA Code **Knowledge Area**
203 Plant Biological Efficiency and Abiotic Stresses Affecting Plants

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

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Development of new knowledge and the transfer of these to clientele to address the effects of climate variability and change

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Forest soils serve as a major reservoir for C, N and nutrients necessary for forest growth, as well as a sink for "pollutants" ranging from metals or N to various organic compounds. Given the uncertainties in rates of turnover in these soils, it is unclear whether they will serve as sources or sinks for various elements in a changing climate. Changes in site quality as a result of changing temperature and moisture regimes under an evolving climate can significantly affect forest productivity and management decisions on both short- and longer-term time frames.

What has been done

Research at the Bear Brook Watershed in Maine has continued. By focusing on a long-term whole forested watershed, this research provides insights unique to understanding the long-term response of forests and streams to a changing chemical and physical climate.

Results

This past year marked the development of a long-term soil solution chemical data series that reinforces understanding of the linkages between the upland soils and the streams in these watersheds. The scientists have made significant progress in defining the degree of phosphorus limitation on nitrogen cycling in both soils and streams, and have defined some of the characteristics of carbon sequestration and cycling across a range of landscape drainage conditions. Their most recent findings suggest that common assumptions about the role of soil drainage in soil carbon accumulation are not always valid, and that other factors can strongly influence traditional concepts of this relationship. They also completed a study on chemical and morphological phenology demonstrating some initial strengths and weaknesses of this tool in climate change research.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|-----------------------------|
| 101 | Appraisal of Soil Resources |

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

{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 FY11, 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 9 peer-reviewed articles and secured \$351,331 in extramural funding. Furthermore, in FY11 research published by faculty in this program area was cited by peers more than 500 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

Nothing to report for this program area this year.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Sustainable Energy

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|---|-----------------|-----------------|----------------|----------------|
| 123 | Management and Sustainability of Forest Resources | | | 52% | |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms | | | 11% | |
| 206 | Basic Plant Biology | | | 4% | |
| 402 | Engineering Systems and Equipment | | | 26% | |
| 605 | Natural Resource and Environmental Economics | | | 3% | |
| 609 | Economic Theory and Methods | | | 4% | |
| | Total | | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2011 | Extension | | Research | |
|--------------------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 1.8 | 0.0 |
| Actual Paid Professional | 0.0 | 0.0 | 2.9 | 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 | 76915 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 215133 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 358526 | 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

| 2011 | 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: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2011 | Extension | Research | Total |
|---------------|-----------|----------|-------|
| Actual | 0 | 5 | 5 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of other publications

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #2

Output Measure

- Number of research projects completed

| Year | Actual |
|-------------|---------------|
| 2011 | 3 |

Output #3

Output Measure

- Number of professional presentations

| Year | Actual |
|-------------|---------------|
| 2011 | 8 |

Output #4

Output Measure

- Outreach to K-12 teachers to promote education on photosynthesis-related topics, focusing on the sea slug system.

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #5

Output Measure

- A hands-on teaching/recruiting experience using sea slug and algal feeding experiments.

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #6

Output Measure

- A new transcriptome database for *Elysia chlorotica*, using high-throughput sequencing.

| Year | Actual |
|-------------|---------------|
|-------------|---------------|

2011 0

Output #7

Output Measure

- Initial database for forest-based bioethanol and "drop-in" biofuels

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #8

Output Measure

- Ongoing modification of Tool for Sustainability Impact Assessment (ToSIA)

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #9

Output Measure

- An integrated sustainability assessment framework for forest based products

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #10

Output Measure

- A spectral database of a mixture of spectral images of woody biomass was created

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #11

Output Measure

- \$ amount of extramural funding received by faculty in this program area

| Year | Actual |
|-------------|---------------|
| 2011 | 506178 |

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 |
| 5 | Develop statistical classification models to predict the chemical characteristics and processing quality of woody biomass |
| 6 | Improve collaboration across disciplines and institutions to successfully conduct research focused on bio-oil and food supplement production from microalgae grown on low-cost lignocellulosic sugars |

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Photosynthesis is the primary determinant of crop productivity. Photosynthesis and the formation of food, fiber, and biomass are dramatically limited by environmental, biochemical, and genetic constraints. Alleviation of some or all of these constraints could lead to substantial increases in plant productivity.

What has been done

Scientists at the University of Maine developed a culture system for rearing sea slugs in the laboratory and establishing the symbiotic association using laboratory-cultured algal prey, *Vaucheria litorea*. PCR and qRT-PCR were also used to examine for presence and expression of 11 genes for algal nuclear encoded chloroplast proteins in individual animals over a feeding time course.

Results

The scientists determined that the plastid association in *Elysia chlorotica* (sea slug) is reversible for the first 6 to 7 days and thereafter, becomes permanent. In their search for examples of gene transfer from the algal prey to the sea slug, they employed 454 pyrosequencing to generate 148 Mbp of cDNA sequence data from actively photosynthesizing adult sea slugs. This approach identified 20 ESTs of potential foreign origin and several plastid-derived transcripts primarily from *V. litorea*, indicating plastid activity. None of these 20 ESTs, however, have a direct involvement in photosynthesis. The researchers are communicating with Carolina Biological about the possibility of technology transfer related to our ability to rear the sea slugs in the laboratory and their potential for development as a teaching tool.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Develop statistical classification models to predict the chemical characteristics and processing quality of woody biomass

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Maine? forest bioproducts industry needs rapid near real-time capabilities using in-process-line sensors to replace slower off-line methods. A first step to developing these sensors is a better understanding of the basic chemical structure of woody biomass through capturing of near-infrared spectra. These data will be used to create an information system that will identify extracts with the highest probability of moving to developing co-product markets. Near-infrared methods will increase the speed with which the woody biomass output stream can be analyzed, saving time and money.

What has been done

MAFES researchers have created a spectral database of a mixture of spectral images. This database was created with the assistance of project collaborators in the Forest Bioproducts Research Institute as well as project industrial collaborators, Old Town Fuel and Fiber.

Results

The nearly 2100 individual spectral images characterize the component chemical compounds in woody biomass extracts that are potentially economically viable pulp and paper co-products for biofuels and biochemicals. The researchers have developed preliminary statistical and chemometric models that illustrate accurate determination for sugar concentration. Other chemicals (such as lignins and xylans) that may complex with the sugars and reduce the ability to convert to viable market co-products were also identified through chemometric modeling but at a much lower accuracy (90% r-coefficient). These outputs have been disseminated through the auspices of the Forest Bioproducts Research Institute during stakeholder meetings.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|-----------------------------------|
| 402 | Engineering Systems and Equipment |

Outcome #6

1. Outcome Measures

Improve collaboration across disciplines and institutions to successfully conduct research focused on bio-oil and food supplement production from microalgae grown on low-cost lignocellulosic sugars

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
|------|--------|

2011

0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In regions of the US where sunlight is limited and the traditional wood products industry is in decline, there is a need to develop alternative feedstocks and novel technologies to support bio-fuel production. The growth of algal biomass for sustainable bioenergy has fewer ecological and social costs compared to the use of higher plants grown on land. Algal bio-oil has been identified as a key replacement for petroleum-based diesel as it requires no substantial modification to existing infrastructure. Autotrophic growth of algal biomass for bio-oil production has low biomass productivity and geological limitations. The advantages of heterotrophic and mixotrophic growth of algae for bio-oil production include increased lipid productivity and the ease of scale-up. However, scientific and technological supports are lacking and additional research is needed to overcome bottleneck issues.

What has been done

Researchers from the University of Maine and the Bigelow Laboratory for Ocean Sciences have formed a team of scientists with expertise in biomaterials science, biology, food science and nutrition, marine sciences/analytic chemistry, economics and marine algae and phytoplankton. Scientists at the Bigelow Laboratory for Ocean Sciences have identified one diatom, *Cyclotella cryptica*, for bio-oil production. The growth conditions of the diatom and *Chlorella protothecoides* grown on cellulose sugars have been optimized in the laboratory of University of Maine for maximum biomass production. An analyzing method had been developed for fast test of the lipid content of algae.

Results

The collaborations have been expanded to additional partners. In addition to scientists from other universities and research labs, partnerships have also been successfully established with industry including Solazyme, Inc., FMC Corporation, LP Building Products, and Technological Innovations, LLC. A general agreement has been reached among all of the organizations that to use the cellulosic residues from wood products industry as a sugars source for heterotrophic growth of algae was a viable approach for sustainable production of bio-oil, value-added structural building products, and food supplements. The researchers also involved the Passamaquoddy Tribe in Maine for potential partnership on development of sustainable bioenergy for the tribal community through implanting the heterotrophic growth technology into their existing algal-growing facility. This established network will facilitate future collaborations on sustainable bioenergy production.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 123 | Management and Sustainability of Forest Resources |
| 402 | Engineering Systems and Equipment |

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

{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 FY11, no 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 \$506,178 in extramural funding. Furthermore, in FY11 research published by faculty in this program area was cited by peers more than 120 times in other peer-reviewed journals. Additionally, the researchers using sea slugs to develop a better understanding of photosynthesis have been communicating with Carolina Biological about the possibility of technology transfer related to their ability to rear the sea slugs in the laboratory and the potential for development for using sea slugs as a teaching tool, thereby extending experiment station research into high school and college science classrooms.

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

The success of a research program can be evaluated in many ways. One such method involves extending techniques developed in the project for educational use. UMaine researchers using sea slugs to develop a better understanding of photosynthesis have been communicating with Carolina Biological about the possibility of technology transfer related to their ability to rear the sea slugs in the laboratory and the potential for using sea slugs as a teaching tool in high school and college science classrooms. These researchers have been working with several high schools in Maine, and the PI was the recipient of a UMaine Center for Excellence in Teaching and Assessment Active Learning Grant with her post-doctoral associate this past year entitled, "Science in minutes: Using a community-based contributory research project as a dual recruitment and learning tool."

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Childhood Obesity

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

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

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2011 | Extension | | Research | |
|--------------------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 1.2 | 0.0 |
| Actual Paid Professional | 0.0 | 0.0 | 1.2 | 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 | 69742 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 131450 | 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?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

| 2011 | 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: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2011 | Extension | Research | Total |
|--------|-----------|----------|-------|
| Actual | 0 | 3 | 3 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of other publications

Year Actual

2011 6

Output #2

Output Measure

- Number of completed research projects

| Year | Actual |
|-------------|---------------|
| 2011 | 1 |

Output #3

Output Measure

- A study to assess the impact of dietary fiber content labeling in the sales of breads and wraps in the University of Maine Memorial Union dining facility

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #4

Output Measure

- A 20-module obesity prevention online curriculum for young adults, 18-24 years old, with two versions, one targeted for college students and one for the non-college, at-risk, at promise young adult population. Module topics include maintaining healthy eating, body weight, being physical activity, and managing time, sleep and stress.

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #5

Output Measure

- Environmental audit instruments modified for college campuses to assess the environment for food, vending, walk-ability and bike-ability with the purpose of creating a healthy campus index tool

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #6

Output Measure

- \$ amount of extramural funding received by faculty in this program area in FY2011

| Year | Actual |
|-------------|---------------|
| 2011 | 18469 |

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 |

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,

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

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

What has been done

In Maine, the Y.E.A.H. (Young Adults Eating and Active for Health), intervention was implemented at a residential job training center over a 6-month time period with assessments at 0, 3, and 6 months. The intervention was designed as a multi-modal, multi-behavior curriculum aimed at improving quality of life through increasing healthful behavior for weight management. Module topics included maintaining a healthy eating, body weight, physical activity, managing time, sleep and stress. Stages-of-Change-based messages, called nudges, about fruit and vegetable intake, physical activity and stress management were distributed weekly.

Results

The ultimate desired outcome of this community-based participatory research was an effective and sustainable program for preventing excessive weight gain and improving the quality of life of young adults. An attempt was made to integrate the intervention into the fabric of the community so that it would continue without the input of the researchers. Community partners made environmental and policy changes to support healthful lifestyles, such as improving access and availability of healthful, high quality foods at dining facilities and fresh drinking water in residential housing. Long term, these emerging adults should have the skills to maintain weight through safe, effective non-diet approaches of healthful eating, physical activity, managing stress and time, and avoiding substances such as alcohol and smoking. Through this multistate work and specifically the work that occurred at the residential training centers in Maine, much has been learned about working in a community setting to effect change and about the dynamics between academic

researchers and community members. The findings will be used in the development of future studies. Once community-based approaches are used, it may be impossible to return to a research environment that is totally researcher driven. Realistic expectations of the community partners will help researchers in planning studies that capitalize on the strengths that are brought to the table.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|----------------------------------|
| 703 | Nutrition Education and Behavior |

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

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Improved weight-gain-prevention programs

Not Reporting on this Outcome Measure

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

{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 FY11, no projects went through the review process in this program area. As for other measures of successful research programs, faculty in this program area published 3 peer-reviewed articles and secured \$18,469 in extramural funding. Furthermore, in FY11 research published by faculty in this program area was cited by peers more than 90 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. As part of multistate project NC1028, researchers in Maine implemented the Y.E.A.H. intervention at a residential job training center over a 6-month time period with assessments at 0, 3 and 6 months.

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

Control and treatment groups participating in the Y.E.A.H. intervention reported similar fruit and vegetable intakes at baseline, 3 months, and 6 months. These findings will be used in the development of future studies, with the ultimate desired outcome being an effective and sustainable program for preventing excessive weight gain and improving the quality of life of young adults.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Food Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|---|-----------------|-----------------|----------------|----------------|
| 311 | Animal Diseases | | | 13% | |
| 315 | Animal Welfare/Well-Being and Protection | | | 12% | |
| 501 | New and Improved Food Processing Technologies | | | 10% | |
| 603 | Market Economics | | | 5% | |
| 607 | Consumer Economics | | | 5% | |
| 701 | Nutrient Composition of Food | | | 12% | |
| 703 | Nutrition Education and Behavior | | | 5% | |
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources | | | 13% | |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins | | | 25% | |
| | Total | | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2011 | 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 | 242675 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 448040 | 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

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

| 2011 | 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: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| | | | |
|---------------|------------------|-----------------|--------------|
| 2011 | Extension | Research | Total |
| Actual | 0 | 9 | 9 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of other publications

| Year | Actual |
|-------------|---------------|
| 2011 | 7 |

Output #2

Output Measure

- Completed research projects

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #3

Output Measure

- Number of professional presentations

| Year | Actual |
|-------------|---------------|
| 2011 | 27 |

Output #4

Output Measure

- Development of a real-time enrichment and detection system for viable Escherichia coli O157:H7 and Listeria monocytogenes by a piezoelectric biosensor quartz crystal microbalance (QCM).

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #5

Output Measure

- A mail survey collecting data from pregnant women about their fish consumption; the data are being used to measure the effectiveness of Maine CDC's education strategy to have pregnant and nursing women switch away from eating fish with high levels of mercury contamination to fish with low levels of contamination.

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #6

Output Measure

- Development of a biosensing method based on aggregation of oligonucleotide-functionalized gold nanoparticles (AuNPs) due to sandwich hybridization of probes and the complementary target sequence for the detection of E. coli O157:H7 by naked eyes.

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #7

Output Measure

- Development of chitosan films containing cranberry concentrate.

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

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 | Development of analytical methods for monitoring organic chemicals in food |
| 8 | Improve mastitis prevention/control efforts for Maine dairy farms |
| 9 | Increase outreach/education efforts for mastitis prevention and control for Maine dairy farms |
| 10 | Increase number of viable technologies to improve food safety for fresh produce |
| 11 | Increase number of viable technologies to improve food safety through the antimicrobial effects of cranberries |

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

Not Reporting on this Outcome Measure

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

Not Reporting on this Outcome Measure

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

Development of analytical methods for monitoring organic chemicals in food

Not Reporting on this Outcome Measure

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 Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2011 | 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

During 2010-2011, a bulk tank filter prototheca survey of Maine dairies was completed, including culture and PCR testing.

Results

Based on this work, a pasteurization resistance study of the prototheca isolates found in Maine was conducted. MAFES scientists found that several of the Maine isolates were not completely eliminated using standard pasteurization methods, and they reported finding to the state CDC and to groups of Maine veterinarians. They are continuing to evaluate sensitivity in all Maine isolates of prototheca and to evaluate mechanisms of resistance. By evaluating milk and filter samples, the researchers will follow the success of Maine farms in eliminating prototheca from their milking herd. Since the diagnostic lab conducts mastitis screening and diagnosis for a number of dairies in the state, they will be able to report overall mastitis pathogen prevalence and antimicrobial resistance pattern to our dairy producers and veterinarians.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|-----------------|
| 311 | Animal Diseases |

Outcome #9

1. Outcome Measures

Increase outreach/education efforts for mastitis prevention and control for Maine dairy farms

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 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

During 2010-2011, a bulk tank filter prototheca survey of Maine dairies was completed, including culture and PCR testing.

Results

Of the 9 Maine farms with prototheca, 4 have participated in outreach efforts including repeated testing and on-farm investigation of possible reservoirs of infection. Attending veterinarians have participated in this outreach, and a followup study to evaluate the effectiveness of teat sealants for prevention and control of prototheca intramammary infection in the dry period is planned.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|-----------------------|
| 311 | Animal Diseases |

Outcome #10

1. Outcome Measures

Increase number of viable technologies to improve food safety for fresh produce

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2011 | 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 developed a novel, simple, inexpensive, instrument-free gaseous ClO₂ approach for disinfection of fresh produce. Gaseous ClO₂ was generated by combining an equal amount of impregnates sodium chloride and activating acids (slow or fast release materials) in a small sachet. After activation, the sachet was placed in a sealable bag containing E. coli O157:H7 inoculated spinach or blueberries.

Results

The researchers found that gaseous ClO₂ is effective for decontamination of E. coli O157:H7 on spinach using the slow release. In addition, the low concentration of ClO₂ over 7 days did not affect visual quality of spinach leaves. The researchers also found that fast release treatment successfully decontaminated the blueberries and that gaseous ClO₂ did not affect the overall visual quality of blueberries. The scientist believe that gaseous ClO₂ could be an affective disinfectant against E. coli O157:H7 on spinach and blueberries. This simple method can easily be incorporated into the existing processes and provides advantages to producers who wish to preserve the appearance of their sanitized produce.

4. Associated Knowledge Areas

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

Outcome #11

1. Outcome Measures

Increase number of viable technologies to improve food safety through the antimicrobial effects of cranberries

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Control of foodborne pathogens and the reduction in the potential health risks to consumers from pathogens is one of the most urgent problems confronting the food industry. Chemical agents with antimicrobial activity have been used as a traditional techniques, but consumers today are increasingly concerned about the safety of these chemical additives in foods and prefer natural and unadulterated foods.

What has been done

MAFES food scientists studied the antimicrobial effects of a cranberry marinade against Salmonella Typhimurium inoculated on chicken wings, along with the consumer acceptability of cranberry marinated chicken wings.

Results

The scientists found that chicken wings marinated with original and double concentrations of cranberry sauce had 1.18 and 1.5 log CFU/g reductions of *S. Typhimurium*, respectively. The marinade containing hot sauce only did not cause any reduction. Their sensory evaluation showed that the original and the double concentrated cranberry marinade had no significant differences from each other in appearance and flavor. Furthermore, they had higher scores than the hot-sauce-only marinade and the control. Texture and overall acceptability ratings of the original cranberry marinated chicken wings were the highest among the other treatments and the control. Considering the antimicrobial effects and health benefits of cranberries, cranberry marinated chicken wings may be a potential safe and healthy product preferred by consumers.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 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 FY11, no projects went through the review process in this program area. As for other measures of successful research programs, faculty in this program area published 9 peer-reviewed articles. Furthermore, in FY11 research published by faculty in this program area was cited by peers more than 130 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.

Researchers involved in testing the antimicrobial effects of a cranberry marinade against *Salmonella Typhimurium* inoculated on chicken wings used consumer testing to gauge the acceptability of cranberry marinated chicken wings.

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

Chicken wings marinated with original and double concentrations of cranberry sauce had 1.18 and 1.5 log CFU/g reductions of *Salmonella Typhimurium*, respectively, while the hot-sauce-only marinade did not cause any reduction. Sensory evaluation showed the original and the double concentrated cranberry marinade had no significant differences from each other in appearance and flavor, and they have higher scores than the hot-sauce-only marinade and the control. Texture and overall acceptability ratings of the original cranberry marinated chicken wings were the highest among the other treatments and the control ($P < 0.05$). Considering the antimicrobial effects and health benefits of cranberries, cranberry marinated chicken wings may be a potential safe and healthy product preferred by consumers.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Sustaining Maine's Natural Resources

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|---|-----------------|-----------------|----------------|----------------|
| 111 | Conservation and Efficient Use of Water | | | 11% | |
| 123 | Management and Sustainability of Forest Resources | | | 9% | |
| 133 | Pollution Prevention and Mitigation | | | 4% | |
| 135 | Aquatic and Terrestrial Wildlife | | | 41% | |
| 136 | Conservation of Biological Diversity | | | 12% | |
| 206 | Basic Plant Biology | | | 7% | |
| 301 | Reproductive Performance of Animals | | | 2% | |
| 306 | Environmental Stress in Animals | | | 5% | |
| 721 | Insects and Other Pests Affecting Humans | | | 7% | |
| 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: 2011 | Extension | | Research | |
|--------------------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 5.0 | 0.0 |
| Actual Paid Professional | 0.0 | 0.0 | 7.0 | 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 | 368456 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 730645 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 394210 | 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

| 2011 | 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: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| | | | |
|---------------|------------------|-----------------|--------------|
| 2011 | Extension | Research | Total |
| Actual | 0 | 10 | 10 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- # of other types of publications

| | |
|-------------|---------------|
| Year | Actual |
| 2011 | 10 |

Output #2

Output Measure

- # of research projects completed

| | |
|-------------|---------------|
| Year | Actual |
| 2011 | 4 |

Output #3

Output Measure

- Number of professional presentations

| | |
|-------------|---------------|
| Year | Actual |
| 2011 | 26 |

Output #4

Output Measure

- Wetland habitat data submitted to federal database system

| | |
|-------------|---------------|
| Year | Actual |
| 2011 | 0 |

Output #5

Output Measure

- Number of Maine towns worked with to map and assess vernal pools

| | |
|-------------|---------------|
| Year | Actual |
|-------------|---------------|

2011 5

Output #6

Output Measure

- Number of Maine towns worked with on advance conservation planning with state and federal regulators

| Year | Actual |
|-------------|---------------|
| 2011 | 2 |

Output #7

Output Measure

- DVD: The Pools of Life: an informational documentary on Maine's vernal pools

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #8

Output Measure

- Maine Municipal Guide to Mapping and Conserving Vernal Pools

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #9

Output Measure

- Number of participants in GET WET! program

| Year | Actual |
|-------------|---------------|
| 2011 | 522 |

Output #10

Output Measure

- Citizen Science Symposium that brought together 35 citizen science practitioners and researchers for a collaborative meeting that involved research presentations, interactive discussions, and field trips

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #11

Output Measure

- \$ amount of extramural funding received by faculty in this program area in FY2011

| Year | Actual |
|-------------|---------------|
| 2011 | 1444178 |

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O. No. | OUTCOME NAME |
|--------|--|
| 1 | # of new software programs created to evaluate borehole flow profile data collected using borehole geophysics |
| 2 | # of new ground-water-modeling programs created to simulate ground-water flow |
| 3 | # of streams identified as promising or critical candidates for native salmonine conservation, based on potential perturbation from invasive species and/or riparian zone management |
| 4 | # of natural resource managers or biologists incorporating research results on conservation of native fishes into official policy and management plans |
| 5 | Number of management agencies using empirical data and model systems to draft recommendation on fish management and conservation |
| 6 | 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. |
| 7 | Recovery actions will be implemented to conserve the endemic Clayton's copper butterfly and its habitat |
| 8 | Increase in the distribution and abundance of migratory fish in Maine |
| 9 | 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 |
| 10 | Scientists, fishermen, and other stakeholders will adopt participatory approaches for producing and using knowledge for marine fisheries management |
| 11 | Adoption of strategies for protecting fish and wildlife habitat |
| 12 | Improve knowledge of, or strategies or tools for, protecting fish and wildlife habitat |

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Domestic wells typically penetrate into the bedrock and extract ground water from fractures. These wells are threatened by a variety of human activities. Once contaminated, a detailed understanding the ground-water hydraulics of fractured bedrock aquifers is required to predict ground-water flow direction and identify potential receptors.

What has been done

MAFES scientists collected borehole geophysical data from five wells across three sites in Maine that were tainted with road deicing salts. Plots of this data have been provided to Maine's Dept. of Transportation to assist in the characterization of subsurface conditions important in evaluating the migration of de-icing salt released into the subsurface. Additionally, the scientists created a computer model, used to interpret vertical borehole flow data, that simulates groundwater flow from fractures into the borehole.

Results

The computer program developed through this project allows water resource professionals to calculate the transmissivities and far-field hydraulic heads in hydraulically active fractures, improving the characterization of subsurface conditions. This additional information is useful when quantifying groundwater processes associated with chemicals released into the subsurface, extraction of groundwater from bedrock aquifers, and interaction of groundwater with ecosystems. Borehole geophysical data provided to MEDOT has aided in the interpretation of the hydraulic inter-connectivity between wells in Mt. Vernon, Maine, that are affected by road deicing salt and is being used to better understand the complex processes related to a decades old release of de-icing salt in Jonesboro, Maine.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #3

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 #4

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 #5

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 Action Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
|-------------|---------------|

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

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

What has been done

MAFES scientists have continued monitoring the effect of dam removals on resident fishes in Sedgeunkedunk Stream.

Results

Their results show distinct patterns in stream fish metrics over time and space due to the presence of a dam. Immediately after removal they saw drastic changes, including sea lamprey, juvenile ATS, and alewife moving upstream into previously inaccessible habitat. This partnership with federal, state, and local governments and the public provides a model of how strong community involvement can drive restoration. NOAA restoration biologists use this project as a model for planned dam removal efforts across the country.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|----------------------------------|
| 135 | Aquatic and Terrestrial Wildlife |

Outcome #6

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 #7

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 #8

1. Outcome Measures

Increase in the distribution and abundance of migratory fish in Maine

Not Reporting on this Outcome Measure

Outcome #9

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

Not Reporting on this Outcome Measure

Outcome #10

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 #11

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 |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Amphibians now are more threatened globally than mammals and birds, yet conservation guidance is general for amphibian populations and often not relevant at either a species or context-specific scale. Rates of decline and extinction are unprecedented, due in large part to habitat loss that creates fragmented aquatic and terrestrial environments. Aquatic habitat loss due to human activity may isolate amphibian populations by altering habitats directly (e.g., wetland draining and conversion, upland development around wetlands) or indirectly, including introduction of alien species (e.g., fish) that consume or compete with amphibians. Amphibian responses to these perturbations may occur within a site and extend throughout a watershed. We must view aquatic and terrestrial habitats as interconnected landscapes to understand how amphibian population organization is affected by modifications within the aquatic system and adjacent terrestrial habitat.

What has been done

MAFES ecologists pursued a landscape genetics approach (a combination of population genetics and landscape ecology) for evaluating how landscape and environmental features shape amphibian population dynamics and to help to identify meaningful conservation units that are species specific and allow for differences dictated by landscape context

Results

Their work on vernal pools has guided wetland and vernal pool conservation strategies at the federal, state, and local level. In consultation with the MAFES researchers, the Army Corps of Engineers (ACOE) adopted the scientists' recommendations on directional buffers as an alternative to circular buffers around pools. These recommendations are now part of the Maine State Programmatic Permit from the ACOE. In addition, 13 Maine municipalities have engaged in some level of proactive management of vernal pool resources.

4. Associated Knowledge Areas

| | |
|----------------|----------------------------------|
| KA Code | Knowledge Area |
| 135 | Aquatic and Terrestrial Wildlife |

Outcome #12

1. Outcome Measures

Improve knowledge of, or strategies or 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 |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Amphibians now are more threatened globally than mammals and birds, yet conservation guidance is general for amphibian populations and often not relevant at either a species or context-specific scale. Forest practices may affect habitat quality for amphibians by changing the moist, cool microclimates that they require.

What has been done

MAFES scientists have studied juvenile movements in clearcuts, light gap cuts, lawns, hayfields, and row crops; over the last year, they have focused on the dominant form of harvest in the Acadian region: heavy partial harvests undertaken in strips with mechanical harvesters. To aid in their studies, they used direct-tracking (i.e., passive harmonic radar direction finding, or HDF technologies), heretofore not used with juvenile amphibians.

Results

In a research partnership with the Dept. of Electrical and Computing Engineering, the scientists are developing novel tracking tools (miniature HDF transponder tags), which will allow them to follow the fate and behavior of individually marked amphibians and ultimately, to assess population connectivity across larger spatial scales. Development of novel tracking tools (harmonic radar tracking systems constituting passive tags of small size, unlimited longevity and individual recognition) may revolutionize current capabilities for tracking juvenile stages, thereby, providing unique insights into amphibian terrestrial ecology and direct quantification of the rate, size, direction, and ultimate location of breeding dispersal. Using this technology, the scientists plan to quantify individual movement for building and validating an individual-based behavioral model to predict juvenile amphibian movement in complex landscapes.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|----------------------------------|
| 135 | Aquatic and Terrestrial Wildlife |

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Several projects were terminated as faculty retired or left the university.

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 FY11, 2 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 and secured \$1,444,178 in extramural funding. Furthermore, in FY11 research published by faculty in this program area was cited by peers nearly 700 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. Scientists investigating methods for conserving native fishes have treated 16 km of streams with wood, impacting 100,000 watershed acres. They are using before-after-control-impact monitoring to quantify results.

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 their results show limited or no changes in the abundance of brook trout since treatment, they believe that high annual variability may have masked patterns, and they need several more years of post-treatment data. These findings will serve to inform future projects and permit managers to compare costs of wood addition (relatively cheap at \$9/m) with benefits of fishery improvement.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Support for Maine's Rural Economy

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 | | | 3% | |
| 111 | Conservation and Efficient Use of Water | | | 3% | |
| 112 | Watershed Protection and Management | | | 1% | |
| 123 | Management and Sustainability of Forest Resources | | | 1% | |
| 134 | Outdoor Recreation | | | 8% | |
| 136 | Conservation of Biological Diversity | | | 20% | |
| 202 | Plant Genetic Resources | | | 2% | |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants | | | 3% | |
| 205 | Plant Management Systems | | | 3% | |
| 206 | Basic Plant Biology | | | 4% | |
| 301 | Reproductive Performance of Animals | | | 2% | |
| 311 | Animal Diseases | | | 4% | |
| 315 | Animal Welfare/Well-Being and Protection | | | 2% | |
| 605 | Natural Resource and Environmental Economics | | | 14% | |
| 608 | Community Resource Planning and Development | | | 23% | |
| 723 | Hazards to Human Health and Safety | | | 7% | |
| | Total | | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

| Year: 2011 | Extension | | Research | |
|--------------------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 4.8 | 0.0 |
| Actual Paid Professional | 0.0 | 0.0 | 6.4 | 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 | 335889 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 458382 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 359105 | 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

| 2011 | 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: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| 2011 | Extension | Research | Total |
|--------|-----------|----------|-------|
| Actual | 0 | 13 | 13 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research projects completed

| Year | Actual |
|------|--------|
| 2011 | 3 |

Output #2

Output Measure

- Number of other publications

| Year | Actual |
|------|--------|
| 2011 | 22 |

Output #3

Output Measure

- Number of professional presentations

| Year | Actual |
|------|--------|
| 2011 | 36 |

Output #4

Output Measure

- Statistical and spatial (GIS) analysis of land change trends in Oregon and Maine. Results to date reveal higher levels of recent land conversion in areas with greater proximity to market and employment centers and in areas with higher stocks of natural resource amenities.

| Year | Actual |
|------|--------|
| 2011 | 0 |

Output #5

Output Measure

- Two new species of the genus *Yulania* Spach of Magnoliaceae were described from Sichuan province of China: *Yulania carnosa* D.L. Fu et D.L. Zhang sp. nov. and *Yulania shizhenii* D.L. Fu

et F.W. Li sp.nov.

| Year | Actual |
|------|--------|
| 2011 | 0 |

Output #6

Output Measure

- Symposium held at the University of Maine Kolunkayowan Wikpiyik II: Protecting the Ash for Future Generations Symposium. May 20, 2011. University of Maine, Orono, ME.

| Year | Actual |
|------|--------|
| 2011 | 0 |

Output #7

Output Measure

- Website: Sustaining Maine's Brown Ash Resource. UMaine Sustainability Solutions Initiative. (<http://www.umaine.edu/brownash/>)

| Year | Actual |
|------|--------|
| 2011 | 0 |

Output #8

Output Measure

- Number of semi-structured interviews with fishermen from eastern Maine fishing communities

| Year | Actual |
|------|--------|
| 2011 | 18 |

Output #9

Output Measure

- Number of oral history interviews with fishermen from eastern Maine fishing communities

| Year | Actual |
|------|--------|
| 2011 | 39 |

Output #10

Output Measure

- A rapid appraisal of fisheries infrastructure and community concerns in 16 fishing communities in eastern Maine

| Year | Actual |
|------|--------|
| 2011 | 0 |

Output #11

Output Measure

- Potential ornamental plants of *Ilex angulata* (Merr. et Chun) and *Ilex centrochinensis* S.Y. Hu were successfully regenerated from cuttings and semi-hardwood cuttings treated with KNAA and KIBA at 1,000 ppm were recommended.

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

Output #12

Output Measure

- \$ amount of extramural funding received by faculty in this program area in FY2011

| Year | Actual |
|-------------|---------------|
| 2011 | 1378997 |

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 | Number of Maine people improving knowledge of ethical behavior when using private land for outdoor recreation |
| 9 | Develop a complex adaptive-systems approach to the study of marine fisheries |

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 |
|-------------|---------------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In 2008, the University of Maine was asked by the City of Portland to conduct an economic impact study of cruise ship passengers on the Portland region. The city was interested in establishing a baseline as it developed strategies to maximize the economic benefits and diversify its economic base.

What has been done

UMaine economists surveyed approximately 2,500 cruise ship passengers from seven different ships and received nearly 1,300 completed returns. The surveys asked questions about the

amount of money passengers spent in the Portland region, the activities they pursued while in port, and several personal characteristics. As a follow-up to this study, researchers collaborated with several cruise-ship-industry stakeholders and helped to produce a 25-minute web-based video designed to help business owners and community officials in coastal Maine to strengthen their marketing efforts.

Results

The study found that cruise ship passengers spend an average of \$80.51 on goods and services in the region. The total economic impact of cruise ship passenger spending, including multiplier effects, was between \$5.8 million and \$8.0 million in sales revenue throughout the Portland region. Economic activity associated with this spending supported between 69 and 96 full- and part-time jobs, and provided between \$2.0 million and \$3.2 million in wages and salaries. Study results have been disseminated through television, radio, newspaper, and magazine accounts, presentations at state, regional, and national conferences and meetings, and through web-based broadcasts. Several small business owners in Maine have become more knowledgeable about the cruise ship market in Maine and have made changes to their business plans as a result of this research. Also, a few Portland area entrepreneurs are evaluating the feasibility of starting new entrepreneurial ventures as a result of this work. The assistant city manager for Portland stated in a recent interview, "The Portland waterfront is a vital economic engine for the state and regional economies. Having the solid, current data, which this report provides, will help us develop long term strategies to maximize the impact of the cruise industry."

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.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Limited fresh water supplies and severe drought experienced in some areas of the United States have made it increasingly important for farmers and growers to use water efficiently. Recent advances in water sensor technology have made it possible for greenhouse growers to use sensor-automated irrigation systems to efficiently water plants. In these systems, plants are irrigated only as they use water. However, there are still many basic questions about plant water use that must be answered for growers to irrigate efficiently, as we understand very little about how plant water use of greenhouse crops is affected by changing light levels, relative humidity, and temperature.

What has been done

As part of multistate research project NE1035, MAFES scientists quantified the water use efficiency of two perennials using a capacitance automated irrigation system and modeled water use of heuchera 'Palace Purple' and heuchera 'Mint Frost'. Although the primary goal of this research is not to focus on survival of microorganisms in soils, the unique nature of the capacitance automated irrigation system at the University of Maine fosters a number of collaborations with researchers in other fields. In the past year, UMaine scientists also collaborated with the USDA-ARS to explore the effect of substrate water content and presence or absence of clover on *E. coli* survival.

Results

The scientists determined that hosta survives a range of water contents from 5% to 45% and, surprisingly, has little change in biomass when grown over that range of water contents. Rosemary, however, did not survive consistently when grown in water contents below 15% water content. The biomass and height of rosemary increased with increasing substrate water content. Since rosemary is used both as an ornamental and an edible herb; this data provided information regarding the impact of irrigation on biomass (in this case yield) of this herb. For heuchera, the scientists determined that vapor pressure deficit was the greatest environmental factor affecting water uptake for both cultivars. In the research on *E. coli* survival, they found that *E. coli* survival is lower in soils maintained near water-holding capacity or planted with clover. This information will help vegetable growers, particularly organic growers who use manure as a source of organic matter or fertility, prevent *E. coli* outbreaks on their farms.

4. Associated Knowledge Areas

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

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.

Not Reporting on this Outcome Measure

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

Number of Maine people improving knowledge of ethical behavior when using private land for outdoor recreation

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|-------------|---------------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Land managers, policy-makers, and communities need science-based strategies to address societal trends that affect outdoor recreation. Particularly important in Maine, a state where much of the land is privately owned, is improving relationships between landowners and those who use the land for hunting, fishing, and other outdoor recreation.

What has been done

MAFES researchers worked with other outdoor recreation researchers to promote collaboration and to provide science-based knowledge that leads to sustainable outdoor environments,

recreation experiences, and healthier communities.

Results

The researchers shared their research results and recommendations with 70 people at the Landowner Relations Conference (sponsored by Small Woodland Owners Association of Maine [SWOAM] and the Sportsmans Alliance of Maine, audience: key policy makers) and 100 people at the Annual SWOAM Meeting during the Agricultural Trade Show (audience: landowners). They also shared results with 700 Department of Inland Fisheries and Wildlife Recreational Safety people (11 regional coordinators, 90 game wardens, and 600 volunteer instructors) in the spring of 2011. These people interact directly with 9,500-10,000 recreation users every year through nearly 500 courses (e.g., hunter safety, snowmobile safety, etc.) and will use this information to promote landowner relations and ethical behavior that can help maintain the ability for the public to use private lands. In the upcoming year, SWOAM will be implementing a pilot program to maintain and enhance recreation access based on our research.

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

Develop a complex adaptive-systems approach to the study of marine fisheries

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Actual |
|------|--------|
| 2011 | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Fisheries in the United States and throughout the world are glaring instances of resource depletion that has come about as the result of poor or inadequate assessment and management. Currently 80 percent of the value of landings in Maine are derived from lobster Maine, since in much of Maine the other historically important fisheries are economically extinct. Any significant decrease in lobster landings would be a social and economic disaster for Maine?s rural coastal

towns.

What has been done

MAFES researchers are working to improve our understanding of the complex social and ecological interactions and the ways we organize and structure the governance of these systems. To this end, the researchers have documented the dynamics of resource depletion in the Maine urchin fishery.

Results

They found that the dynamics are significantly different from those conceived in standard fisheries theory and management practice. Rather than the slow fishing down of a large population with a broad geographic range, the scientists' findings point rather conclusively to a very fine-scale process of depletion that removes one after another very local functional units, i.e., ledge-level populations, in the fishery. These findings strongly imply the need to change management, moving towards finer scale units. Their biophysical model demonstrates the natural, fine-scale urchin aggregations that result from seaweed and urchin interactions. These local aggregations make fishing profitable at abundance levels that are low enough to extirpate local functional units.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 605 | Natural Resource and Environmental Economics |

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Several projects were terminated as faculty retired or left the university.

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 FY11, no projects went through the review process in this

program area. As for other measures of successful research programs, faculty in this program area published 13 peer-reviewed articles and secured \$1,378,997 in extramural funding. Furthermore, in FY11 research published by faculty in this program area was cited by peers more than 150 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. In a study investigating the benefits of outdoor recreation, researcher evaluated outcomes by formal and informal stakeholder feedback, discussions with potential users of knowledge, annual performance reviews, requests for outreach presentations/programs, and number of people attending presentations and participating in activities.

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

By evaluating the role or effectiveness of natural resource managers to communicate benefit opportunities, researchers identified the importance of trust within effective natural resources management. The management significance of this research was a series of suggestions for improving relationships between communities, agencies, and agency managers based on the different factors of trust. The researchers also evaluated a media campaign at Acadia National Park, where found trail use increased 88% after the campaign. The results were helpful in identifying how knowledge, attitudes, and behavior could guide future media campaigns. The Health & Recreation Committee of the National Park System used the results from Acadia to anticipate how different visitor market segments will respond to other media campaigns.