

2014 University of Maine Research Plan of Work

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I. Plan Overview

1. Brief Summary about Plan Of Work

The Maine Agricultural and Forest Experiment Station is the University of Maine's center for applied and basic research in agriculture and food sciences, forestry and wood products, marine systems, fisheries and aquaculture, wildlife, outdoor recreation, and rural economic development. The station's programs strive to enhance the profitability and sustainability of Maine's natural-resource-based industries, protect Maine's environment, and improve the health of its citizens.

In addition to identifying and addressing agricultural and natural-resource research needs of Maine, the programs of the Maine Agricultural and Forest Experiment Station strives to address today's grand challenges in foods and agriculture. These challenges are reflected in the USDA National Institute of Food and Agriculture's five thematic areas for research: global food security and hunger, mitigation and adaptation to climate change, improving nutrition and ending child obesity, improving food safety and securing America's energy future. Maine's plan of work for 2014 (fiscal years 2014-2018) herein has a substantial focus on three of these challenge areas (global food security and hunger, climate change, and food safety) and supports economic development in Maine's agricultural and natural resource sectors. The research described in this plan of work falls under five broad program areas: Global Food Security and Hunger; Climate Change; Food Safety; Sustaining Natural Resources; and Supporting Rural Economies. The research in our sixth program area, Supporting Forest Industries, is funded by McIntire-Stennis and is not covered by this plan of work.

Agriculture, forestry, aquaculture, and marine fisheries are important sectors of Maine's economy. The industries and small businesses at the core of these sectors are the foundation for allied businesses in food processing, wood products, and other goods and services. Maine's natural resources also attract millions of tourists each year who support an important hospitality sector. Maine has unique advantages in these sectors, but as in all business arenas, research and development are continually needed to remain competitive in regional, national and international markets. In the case of agriculture, Maine is relatively close to major markets in Boston and New York. In forestry, Maine is the most forested state in the nation and is well-positioned to compete in emerging bio-energy markets. And Maine's more than 3,500 miles of coastline provides unique opportunities for aquaculture, fisheries, and tourism industries. This updated plan of work is part of the Maine Agricultural and Forest Experiment Station's efforts to continually adjust research programs to help Maine businesses and producers exploit new opportunities and meet current and anticipated challenges.

Research to protect Maine's environment and promote public health are important goals within this plan of work. High-priority environmental research in this plan focuses on aquatic systems (ground water, lakes, rivers, inland and coastal wetlands, and the Gulf of Maine), endangered species, and ecosystem sustainability. Maine has the potential to be a prime testing ground for research on adapting to global climate change because the climatic variation within Maine is expected to be generally greater than other states in the U.S. This plan of work continues our focus on food safety technologies, health benefits of agricultural foods, and research to promote healthy eating and lower obesity rates in youth.

Administrators of the Maine Agricultural and Forest Experiment Station recognize the value of regional collaboration and coordination of research activities. MAFES faculty members are encouraged to coordinate with scientists at other stations in the northeast region and nation in partnership with the USDA National Institute of Food and Agriculture. In addition, station administrators are actively involved in initiatives of the Northeastern Regional Association of State Agricultural Experiment Station Directors to encourage regionally coordinated research. These initiatives include planning grant programs and hosting research forums on high priority issues. Maine, New Hampshire, and Vermont stations have begun a research funding initiative to encourage development of faculty research to address issues common to the northern New England given the similar climate, environments, demographics, and opportunities for the region. The Northern New England Research Funding Program, a seed grant program, began in January 2013 with release of the first RFA. The overall goal of the program is to catalyze coordinated regional research on high-priority needs for the northern New England region in experiment station mission areas. This focus area for 2013 is adaptation to or mitigation of climate variability and change by agriculture in northern New England. Successful projects will have at least one coinvestigator from each of the three experiment stations and include clear justification for the work from stakeholder perspectives.

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

Year	Extension		Research	
	1862	1890	1862	1890
2014	0.0	0.0	37.1	0.0
2015	0.0	0.0	37.1	0.0
2016	0.0	0.0	37.1	0.0
2017	0.0	0.0	37.1	0.0
2018	0.0	0.0	37.1	0.0

II. Merit Review Process

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

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

2. Brief Explanation

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

Once approved by the Research Council, pre-proposals are distributed to advisory

committees to elicit their input on the importance of the issues addressed within the pre-proposals.

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

III. Evaluation of Multis & Joint Activities

1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

Many of the multistate projects and integrated research and extension programs of the Maine Agricultural and Forest Experiment Station contribute to the high-priority needs identified by stakeholders, both within Maine and throughout the nation. In fact, agricultural producers in two important agricultural sectors in Maine contribute additional funding to the station's programs annually. These funds originate from voluntary assessments on farm production.

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

Apple growers in the northern regions of the United States are in need of new varieties that are desired by consumers and more vigorous rootstocks that improve yield and profitability, and are resistant to freeze damage. NC140--Improving Economic and Environmental Sustainability in Tree-Fruit Production Through Changes in Rootstock Use--addresses part of this critical stakeholder need by evaluating new rootstock at several locations with differing climates.

NE1028--Mastitis Resistance to Enhance Dairy Food Safety--is an example of a multistate project with national reach. Dairy farmers across the country face the same problems, and the growing numbers of organic dairy farms particularly need research on safe, effective, and organically certified methods to treat and/or prevent mastitis infections.

The negative health effects associated with obesity are a critical issue facing this country. Multistate project NC1193--Assessing and Addressing Individual and Environmental Factors that Influence Eating Behavior of Young Adults--is working to develop ways to prevent young adults from gaining excessive weight and to encourage healthy eating and exercise habits that will enable them to maintain a healthy weight for their entire lives.

For integrated extension and research activities, researchers and extension personnel at UMaine are developing an IPM program for the wild blueberry industry of Maine. The goal of

this program is to improve yields, reduce weed and insect problems, reduce pesticide use and avoid the cost of inputs that do not contribute to plant health or production. This program is highly valued by wild blueberry growers and is being widely adopted. Some of the applied research is performed on stakeholders' farms.

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

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

Both the Maine Agricultural and Forest Experiment Station and the University of Maine Cooperative Extension will continue their efforts to identify both underserved and underrepresented groups in the state and MAFES will develop new integrated programs with UMCE to address those needs.

Both multistate research projects and programs integrated with UMCE represent programs available to MAFES to serve the needs of these populations.

Several of our multistate projects and integrated research and extension programs currently address needs of the underserved and underrepresented populations in Maine. NC1193--Assessing and Addressing Individual and Environmental Factors that Influence Eating Behavior of Young Adults examines the effectiveness of different intervention materials to encourage an increase in the consumption of fruits and vegetables in the diet of young adults. If successful, the project should reduce diet-related illnesses and obesity as this segment of the population ages. Participation by experiment station researchers in NE1029--Rural Change: Markets, Governance and Quality of Life--will improve the information available to Maine's rural leaders and residents as they try to encourage economic activities while preserving the character of their communities. Maine's rural communities exhibit relatively slow economic growth and in general believe they have been underserved by state economic development efforts. This multistate project focuses station research efforts on economic development needs for these communities.

Although neither an integrated nor a multistate project, a recent Hatch project (Using Temperature and Flow Profiling to Evaluate Groundwater Interaction with Surface Water in Maine) is working with an underserved, underrepresented population, the Houlton Band of Maliseets, to assist with ongoing fish habitat restoration efforts. Likewise after discussions with leaders of Maine's native tribes, faculty involved in a McIntire-Stennis project (Tree Diebacks, Declines, and Management Prioritization) are focusing their research on the impending introduction of the emerald ash borer, which will have negative impacts on brown ash in Maine, a vital resource for Maine's native basketmakers.

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

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

4. How will the planned programs result in improved program effectiveness and/or

Multistate research projects allow researchers to accomplish more as a research team than they can accomplish individually. A good example of the improved effectiveness and efficiency is the multistate potato clones project identified above. Through the multistate format, new potato clones can be tested in multiple locations on the East Coast

simultaneously, and the various breeding programs in the east can specialize in characteristics for which they develop clones as the other breeding programs take the lead for developing clones with other desirable characteristics. The multistate project examining mastitis resistance is a good example of regionally coordinated research to address a current national challenge, the magnitude and scope of which extend far beyond the ability of any one institution.

Integrated programs also improve effectiveness by more efficiently distributing the results of the research performed by station scientists. Integrated programs also improve the identification of new research needs by facilitating the flow of information between the stakeholders and the researchers in MAFES.

IV. Stakeholder Input

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

- 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.

Stakeholder input related to research needs is conducted on a continual basis. The manner in which the input is sought is variable, including informal discussions between Experiment Station staff/faculty and traditional and non-traditional stakeholder groups/individuals, more formal settings designed to specifically discuss stakeholder research needs, surveys of traditional groups/individuals, and surveys of the general public. The frequency in which the different methods are used is also variable. Informal discussions occur continuously. For example, the associate director participates in monthly meetings of the Agricultural Council of Maine. Formal meetings to elicit input occur every one to three years, For example the director and associate director meet annually with the Wild Blueberry Commission of Maine and twice annually with the Board of Agriculture, a legislatively mandated board to advise the university on issues related to agriculture.

Surveys of stakeholders are usually conducted every three to five years, . usually done in conjunction with Cooperative Extension and the University of Maine Board of Agriculture, Surveys of the general public are usually done every five to seven years.

All identified groups/individuals are asked and encouraged to provide the input being sought.

Once new groups/individuals are identified, they are placed on a listing of the groups/individuals from whom information is sought on a continual basis.

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

1. Method to identify individuals and groups

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

Brief explanation.

Existing advisory committees are good sources of information for identifying new stakeholder groups and individuals with an interest in station programs. Members of advisory groups are aware of new groups that have formed and of any individuals who have assumed leadership positions, either as individuals or leaders of the new stakeholder groups.

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

Finally, meetings with advisory groups, individual stakeholder groups, and other potential interested parties and individuals will be held periodically around the state to elicit input and help us to identify new groups and individuals to work with in the future.

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

1. Methods for collecting Stakeholder Input

- 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.

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.

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

issues. Adjustments in short-term objectives are made regularly in these on-going research programs to address the emerging issues.

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

V. Planned Program Table of Content

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

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

2. Brief summary about Planned Program

Advancing global food security within the context of an increasing human population requires ongoing research and development in new technologies and production systems to ensure the availability of sufficient, nutritionally adequate food that allows all people to maintain active and healthy lives. It's an enormous issue, however, which can be broken into many smaller parts. In addition to ensuring access to sufficient food for a growing population, global food security requires that food producers have access to arable land with healthy soils and adequate water for crop and livestock production. Producers need ways to manage ever-changing disease and pest threats and crop varieties that improve productivity. Food production also needs to be profitable to encourage continued expansion of the farming sector to meet future demands.

The Maine Agriculture and Forest Experiment Station conducts research to boost Maine's agricultural productivity, focusing on the fruits, vegetables, and animals important to Maine's food producers: potatoes, blueberries, apples, small fruits and vegetables, dairy, and marine aquaculture. Within the Global Food Security and Hunger program area, researchers conduct basic and applied research that aims to increase the sustainability, productivity, and profitability of production, processing, marketing, and international export of Maine food products.

In the Global Food Security and Hunger program area, MAFES scientists are exploring new ways to control plant diseases, weeds, and insect pests to ensure sufficient food resources. They are looking to increase the productivity of Maine crops, by developing and testing new vegetable and fruit varieties and investigating ways to increase yields and improve soil quality through new soil management techniques.

To ensure the productivity of Maine's animal food sources, they are working to increase the reproductive success of dairy cows; to develop new stocks of oysters; to develop and test new fish diets for marine aquaculture species; and to improve overall animal health. Researchers are also working to help Maine farms and food producers become more profitable through development of new, value-added products, reducing use of purchased inputs, increasing quality of Maine food products, and improving marketing efforts.

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

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

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

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

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			10%	
202	Plant Genetic Resources			8%	
204	Plant Product Quality and Utility (Preharvest)			3%	
205	Plant Management Systems			12%	
211	Insects, Mites, and Other Arthropods Affecting Plants			6%	
212	Pathogens and Nematodes Affecting Plants			7%	
213	Weeds Affecting Plants			8%	
216	Integrated Pest Management Systems			3%	
301	Reproductive Performance of Animals			4%	
302	Nutrient Utilization in Animals			3%	
303	Genetic Improvement of Animals			3%	
305	Animal Physiological Processes			4%	
311	Animal Diseases			10%	
403	Waste Disposal, Recycling, and Reuse			2%	
501	New and Improved Food Processing Technologies			2%	
502	New and Improved Food Products			3%	
601	Economics of Agricultural Production and Farm Management			3%	
605	Natural Resource and Environmental Economics			6%	
702	Requirements and Function of Nutrients and Other Food Components			3%	
	Total			100%	

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

1. Situation and priorities

Maine's potato industry encompasses more than 500 businesses generating nearly \$280 million in annual sales, employing more than 2,600 people, and providing more than \$100 million in income to Maine residents. Maine potatoes are exported both nationally and internationally. Potato production in Maine is concentrated in Aroostook County and central Penobscot County. Potato production in the Northeast is highly dependent on expensive chemical fertilizers and pesticides, yet productivity has not increased

dramatically over the past 50 years. Maine potato growers need new strategies for controlling insect pests, such as the Colorado potato beetle, plant diseases caused by *Rhizoctonia solani*, *Phytophthora infestans*, *P. erythroseptica*, and *Spongospora subterranea*, and weeds. Potato growers in Maine and the eastern U.S. also need new potato varieties with better disease/pest resistance and better quality for fresh and processing markets. Furthermore, they need new management systems that produce the yields and quality needed for profitability.

Wild blueberries are a unique agricultural crop in that they occur naturally in Maine and are cultivated in Maine and Maritimes Canada, with limited production in other states. Wild blueberries are grown on more than 500 farms on 64,000 acres in Maine. Maine produces the most blueberries of any state or province in North America, with an average production of more than 75 million pounds a year. Maine blueberries are exported around the world and make up about 50% of the world's wild blueberry crop. Developing new nutrient recommendations for wild blueberry will improve productivity on low-yielding fields and increase the profitability of the wild blueberry industry. Additionally, Maine's wild blueberry growers need improved tools for managing weed and insect pests and plant diseases.

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

Maine's fisheries and aquaculture industries are comprised of marine fish and shellfish species, including Atlantic salmon, groundfish stocks, lobster, crab, clam, mussel, and oyster. Many Maine seafood products, most notably lobster, are exported around the world as well as across the country. The fish aquaculture industry in Maine is currently dominated by Atlantic salmon, but to ensure its sustainability, Maine's aquaculture industry needs other potential marine aquaculture species, new, less-expensive fish diets, and new methods for treating diseases. Maine's shellfisheries also face challenges, and need new methods of disease control, ways to repel invasive predatory species, and stock that performs well in Maine's cold water.

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

2. Scope of the Program

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

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

1. Assumptions made for the Program

Funding will stay the same; staffing levels will stay the same; participation from both oyster and mussel growers in the state; requires highly qualified hatchery personnel; requires use of the University of Maine Zebrafish Facility and trained personnel to monitor the fish stocks; continued integration with UM Cooperative Extension; potato industry will remain important for Maine economy; apple production will remain stable but replanting will increase; cooperation with scientists from state and federal research

programs involved in genetic improvement of potato and other solanaceous species; weed insect and disease pressure will continue; growers will continue to adopt new practices, cooperate with researchers on projects, and learn to use new pest control materials to be able to control these pests; the slow rate at which new pesticides are developed, and increasing public pressure for environmental stewardship, will require the farming sector to increasingly rely on knowledge of the ecology of agroecosystems to produce equal or greater crop yields, of improved quality, with less reliance on pesticides for crop protection

2. Ultimate goal(s) of this Program

To increase global food security by enhancing the sustainability, productivity, and profitability of production, processing, marketing, and exporting for Maine food producers.

V(E). Planned Program (Inputs)

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

Year	Extension		Research	
	1862	1890	1862	1890
2014	0.0	0.0	15.0	0.0
2015	0.0	0.0	15.0	0.0
2016	0.0	0.0	15.0	0.0
2017	0.0	0.0	15.0	0.0
2018	0.0	0.0	15.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

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

Extension	
Direct Methods	Indirect Methods

3. Description of targeted audience

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

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Enhanced capacity of a sustainable global food system including new/improved plants, animals, technologies, and management systems
2	More sustainable, diverse, and resilient food systems in Maine

Outcome # 1

1. Outcome Target

Enhanced capacity of a sustainable global food system including new/improved plants, animals, technologies, and management systems

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 202 - Plant Genetic Resources
- 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
- 213 - Weeds Affecting Plants
- 216 - Integrated Pest Management Systems
- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes
- 311 - Animal Diseases
- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products
- 601 - Economics of Agricultural Production and Farm Management
- 605 - Natural Resource and Environmental Economics
- 702 - Requirements and Function of Nutrients and Other Food Components

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

More sustainable, diverse, and resilient food systems in Maine

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships

- 202 - Plant Genetic Resources
- 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
- 213 - Weeds Affecting Plants
- 216 - Integrated Pest Management Systems
- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes
- 311 - Animal Diseases
- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products
- 601 - Economics of Agricultural Production and Farm Management
- 605 - Natural Resource and Environmental Economics
- 702 - Requirements and Function of Nutrients and Other Food Components

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect 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.)

Description

{NO DATA ENTERED}

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

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. 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.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

2. Brief summary about Planned Program

As concern about the timing, magnitude, and rate of future climate change increases, it is crucial that we have a better understanding of both how the mechanisms that govern climate variability work and what potential impacts may be experienced in Maine.

Home to the Climate Change Institute, the University of Maine is a recognized leader in discovery research on global climate change. Maine's location creates a prime testing ground for research on climate change, as it falls along the northernmost extent of the range of some species and the southernmost extent of the range of others. Scientists in the Maine Agricultural & Forest Experiment Station investigate the effects of climate on Maine's natural resource-based industries, particularly, agriculture, forestry, marine fisheries, and outdoor recreation and tourism.

In the Climate Change program area, MAFES scientists are investigating the effects of climate on Maine plant and animal wildlife. Scientists are developing biochemical metrics for Maine's aquatic resources. To ensure a viable apple industry, scientists are investigating the interaction between climate and apple rootstocks.

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

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

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

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

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources			4%	
102	Soil, Plant, Water, Nutrient Relationships			11%	
112	Watershed Protection and Management			13%	
123	Management and Sustainability of Forest Resources			21%	
133	Pollution Prevention and Mitigation			5%	
135	Aquatic and Terrestrial Wildlife			8%	
136	Conservation of Biological Diversity			8%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			17%	
204	Plant Product Quality and Utility (Preharvest)			4%	
211	Insects, Mites, and Other Arthropods Affecting Plants			3%	
212	Pathogens and Nematodes Affecting Plants			3%	
213	Weeds Affecting Plants			3%	
	Total			100%	

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

1. Situation and priorities

Climate data for the Northeast show that average annual temperatures have increased in the region by +1.8 F over the last century. The data also show a greater rate of warming during the winter months, a slight increase in length of the growing season, and an increase in the frequency of extreme precipitation events.

For Maine agriculture, these changes in climate may lead to changes in disease, weed, and pest pressures. Furthermore, certain crops that do well in cooler climates may not perform as well with warmer annual temperatures. Changes in precipitation may also require new crop varieties or new methods for dealing with field flooding and soil changes. Since there is much uncertainty about the effects of climate change, it will be crucial for Maine farmers to have access to current scientific research on the best ways to adapt to the new conditions.

Potential new invasive plant and animal species will affect Maine's forest, fishery, and outdoor recreation and tourism industries. Changing ocean temperatures will have an effect on Maine's marine aquaculture and fisheries industries. Loss of particular tree species due to warming temperatures may have a negative impact on Maine's forest industry and its maple sugar producers, along with the tourism industry, which relies heavily on fall foliage tourism. Maine's wildlife attracts many hunters, anglers, and wildlife watchers, who may no longer visit the state if certain species no longer live within its borders. It will be important for people who manage these resources and for state policymakers to have a better understanding of the relationships between climate, habitat, and species composition. One of the

challenges for successful environmental management, however, is the need for indicators that permit one to monitor the condition of the resource, to detect changes in the resource, to understand why a resource is changing, and to make predictions about the future condition of the resource.

In the Climate Change program area, experiment station scientists conduct basic and applied research on the effects of climate on Maine's forests, aquatic resources, wildlife, plant crops, along with the policy issues affecting land use. Much of the research in this program area, however, is funded by McIntire-Stennis and, as such, is outside of the scope of this Plan of Work.

2. Scope of the Program

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

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

1. Assumptions made for the Program

Funding will stay the same; staffing levels will stay the same; cooperation with scientists from state and federal research programs; climate change will affect weed, insect, and disease pressures and productivity of Maine crops; climate change will lead to new invasive plant and animal species; climate change will lead to change in range for some plant and animal species

2. Ultimate goal(s) of this Program

To develop a better understanding of the effects of climate change on Maine's natural-resource-based industries, particularly, agriculture, forestry, marine fisheries, and outdoor recreation and tourism.

V(E). Planned Program (Inputs)

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

Year	Extension		Research	
	1862	1890	1862	1890
2014	0.0	0.0	3.9	0.0
2015	0.0	0.0	3.9	0.0
2016	0.0	0.0	3.9	0.0
2017	0.0	0.0	3.9	0.0
2018	0.0	0.0	3.9	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

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

Extension	
Direct Methods	Indirect Methods

3. Description of targeted audience

Maine natural-resource-based industries, Cooperative Extension staff, other scientists, state and federal policymakers, regulators, and legislators, classroom teachers

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of other publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Development of new knowledge and technologies and the transfer of these to clientele to address the effects of climate variability and change
2	Enhance adaptive capacity of production and natural systems to reduce exposure and vulnerability to climate change
3	Improve mitigation strategies for the reduction of greenhouse gas emissions and increase carbon sequestration in production and natural systems and communities

Outcome # 1

1. Outcome Target

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

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 112 - Watershed Protection and Management
- 133 - Pollution Prevention and Mitigation
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

Enhance adaptive capacity of production and natural systems to reduce exposure and vulnerability to climate change

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 112 - Watershed Protection and Management
- 133 - Pollution Prevention and Mitigation
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Improve mitigation strategies for the reduction of greenhouse gas emissions and increase carbon sequestration in production and natural systems and communities

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 112 - Watershed Protection and Management
- 133 - Pollution Prevention and Mitigation
- 136 - Conservation of Biological Diversity
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

{NO DATA ENTERED}

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

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. 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.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Food Safety

2. Brief summary about Planned Program

With several recent outbreaks of foodborne infections and intoxicants in the U.S., the issue of food safety and pathogen control has become a central concern for consumers and food producers alike. Foodborne illnesses account for billions of dollars of economic losses annually.

In the Food Safety program area, Maine Agricultural & Forest Experiment Station food scientists are developing new methods and technologies aimed at ensuring the quality of Maine food products and preventing foodborne illnesses. Scientists are also investigating how consumers respond to and perceive health-related information about food.

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

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

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

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

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
311	Animal Diseases			17%	
501	New and Improved Food Processing Technologies			7%	
502	New and Improved Food Products			17%	
603	Market Economics			3%	
607	Consumer Economics			3%	
703	Nutrition Education and Behavior			3%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			50%	
	Total			100%	

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

1. Situation and priorities

Food production and processing is important in several key sectors in Maine: dairy, fisheries, potatoes, blueberries, and other fruits and vegetables. 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. Maine food producers need new rapid techniques to test for the presence of pathogens. Although food producers have long used chemical agents with antimicrobial activity to control foodborne pathogens, consumers today are increasingly concerned about the safety of these chemical additives in foods and prefer natural and unadulterated foods. Using Maine crops, such as blueberry and cranberry, to develop antimicrobial compounds will benefit the growers, food producers, and consumers. Maine's food producers and processors need help assessing the quality of their products, along with new techniques and technologies for preserving food quality and extending shelf life.

2. Scope of the Program

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

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

1. Assumptions made for the Program

Funding will remain constant; staffing levels will remain the same. Maine's food commodity groups will remain stable. Concern over food-borne pathogens will remain the same or increase.

2. Ultimate goal(s) of this Program

To improve the safety of Maine food products and help Maine food producers and processors to become more profitable

V(E). Planned Program (Inputs)

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

Year	Extension		Research	
	1862	1890	1862	1890
2014	0.0	0.0	2.6	0.0
2015	0.0	0.0	2.6	0.0
2016	0.0	0.0	2.6	0.0
2017	0.0	0.0	2.6	0.0
2018	0.0	0.0	2.6	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

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

Extension	
Direct Methods	Indirect Methods

3. Description of targeted audience

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

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Increase number of viable technologies to improve food safety
2	Reduce incidence of foodborne illness
3	Increase adoption of recommended safe food-handling practices at the individual, family, community, production and supply system levels.

Outcome # 1

1. Outcome Target

Increase number of viable technologies to improve food safety

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 311 - Animal Diseases
- 501 - New and Improved Food Processing Technologies
- 603 - Market Economics
- 607 - Consumer Economics
- 703 - Nutrition Education and Behavior
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

Reduce incidence of foodborne illness

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 311 - Animal Diseases
- 501 - New and Improved Food Processing Technologies
- 603 - Market Economics
- 607 - Consumer Economics
- 703 - Nutrition Education and Behavior
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Increase adoption of recommended safe food-handling practices at the individual, family, community, production and supply system levels.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 311 - Animal Diseases
- 501 - New and Improved Food Processing Technologies
- 603 - Market Economics
- 607 - Consumer Economics
- 703 - Nutrition Education and Behavior
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

{NO DATA ENTERED}

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

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. 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.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Sustaining Natural Resources

2. Brief summary about Planned Program

When most people think of Maine, they think of its natural resources: its lakes, streams, and rivers, its scenic coastline, its forests, and the fish, animal, and plant species these areas support. Maine citizens value these resources highly, and judging by Maine's \$3 billion tourism industry, people from across the country and around the world also value them. Therefore, it is a critical part of the Maine Agricultural & Forest Experiment Station's mission to provide the research necessary to conserve and preserve these resources.

The Sustaining Maine's Natural Resources program area comprises discovery research projects that focus on aspects of Maine's natural resources: water, soil, and air quality and conservation of Maine's plant and wildlife species. MAFES water research is monitoring the health and quality of Maine's ground water, rivers, and lakes. Wildlife biologists are investigating the status, distribution, and habitat requirements of harbor and gray seal. Other research examines the effects of resource availability and quality on individual growth, breeding success, and survival of migrant and resident birds populations and ways to improve stream habitat for fish.

Some of the Experiment Station's research on Maine's natural resources is funded through the McIntire-Stennis Act and does not fall under the scope of this document.

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

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

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

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

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
111	Conservation and Efficient Use of Water			8%	
123	Management and Sustainability of Forest Resources			11%	
131	Alternative Uses of Land			2%	
132	Weather and Climate			2%	
134	Outdoor Recreation			8%	
135	Aquatic and Terrestrial Wildlife			21%	
136	Conservation of Biological Diversity			22%	
206	Basic Plant Biology			8%	
215	Biological Control of Pests Affecting Plants			7%	
301	Reproductive Performance of Animals			2%	
306	Environmental Stress in Animals			6%	
605	Natural Resource and Environmental Economics			1%	
723	Hazards to Human Health and Safety			2%	
	Total			100%	

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

1. Situation and priorities

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

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

The natural resources program area needs answers to basic questions about how these systems work, what effects changes in one aspect have on the system as whole. Therefore the outcomes for this

program area mainly represent changes in our knowledge base. MAFES scientists are laying the foundation for further research and for other agencies to develop applications that help manage Maine's natural resources.

2. Scope of the Program

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

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

1. Assumptions made for the Program

Funding will stay the same; staffing levels will stay the same; research space will be available; collaborations with the Maine Departments of Environmental Protection and Inland Fisheries and Wildlife, Atlantic Salmon Commission, U.S. Fish and Wildlife Service and the National Marine Fisheries Service and citizen groups will continue; permits for fish sampling will be approved.

2. Ultimate goal(s) of this Program

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

V(E). Planned Program (Inputs)

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

Year	Extension		Research	
	1862	1890	1862	1890
2014	0.0	0.0	7.0	0.0
2015	0.0	0.0	7.0	0.0
2016	0.0	0.0	7.0	0.0
2017	0.0	0.0	7.0	0.0
2018	0.0	0.0	7.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

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

Extension

Direct Methods	Indirect Methods

3. Description of targeted audience

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

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Improve knowledge of, or strategies and tools for, protecting fish and wildlife habitat
2	Adoption of strategies for protecting fish and wildlife habitat
3	New strategies for improving and/or preserving surface and ground water quality
4	Adoption of strategies for improving/preserving surface and ground water quality
5	Enhance sustainability, diversity, and resiliency of Maine's natural resource-based industries
6	Improve health, distribution, and/or abundance of crucial plant and animal species

Outcome # 1

1. Outcome Target

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

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 111 - Conservation and Efficient Use of Water
- 131 - Alternative Uses of Land
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 206 - Basic Plant Biology
- 301 - Reproductive Performance of Animals
- 306 - Environmental Stress in Animals

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

Adoption of strategies for protecting fish and wildlife habitat

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 111 - Conservation and Efficient Use of Water
- 131 - Alternative Uses of Land
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 206 - Basic Plant Biology
- 301 - Reproductive Performance of Animals
- 306 - Environmental Stress in Animals

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

New strategies for improving and/or preserving surface and ground water quality

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 111 - Conservation and Efficient Use of Water
- 131 - Alternative Uses of Land

4. Associated Institute Type(s)

- 1862 Research

Outcome # 4

1. Outcome Target

Adoption of strategies for improving/preserving surface and ground water quality

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 111 - Conservation and Efficient Use of Water
- 131 - Alternative Uses of Land

4. Associated Institute Type(s)

- 1862 Research

Outcome # 5

1. Outcome Target

Enhance sustainability, diversity, and resiliency of Maine's natural resource-based industries

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 131 - Alternative Uses of Land
- 134 - Outdoor Recreation
- 135 - Aquatic and Terrestrial Wildlife

- 136 - Conservation of Biological Diversity
- 206 - Basic Plant Biology
- 301 - Reproductive Performance of Animals
- 306 - Environmental Stress in Animals
- 723 - Hazards to Human Health and Safety

4. Associated Institute Type(s)

- 1862 Research

Outcome # 6

1. Outcome Target

Improve health, distribution, and/or abundance of crucial plant and animal species

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 131 - Alternative Uses of Land
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 206 - Basic Plant Biology

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect 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)

Description

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

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

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. 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.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Supporting Rural Economies

2. Brief summary about Planned Program

Although Maine's rural population has grown in total numbers since 1980, the percentage of the state's population living in rural areas has dropped from 44% to 42% over that time period. Poverty and unemployment rates are also both higher in rural areas of the state. Maine's rural economies rely on several key industries (agriculture, forestry, tourism and recreation, and marine fisheries), most of which have been hard hit by the recent economic downturn and global competition. Some of Maine's rural areas are facing intense development pressure, with the concomitant issues of sprawl and debates concerning land use.

The Support for Maine's Rural Economies program area comprises research on a range of issues affecting Maine's rural people and communities. Researchers are looking for ways to increase the profitability of Maine's horticultural and green industries. They are addressing the issues surrounding management of Maine's commercial fisheries. Researchers are also providing their expertise on nature-based tourism and rural labor markets and studying the effects on human health of exposure to certain environmental and/or occupational toxicants.

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

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

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

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

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships			4%	
111	Conservation and Efficient Use of Water			4%	
112	Watershed Protection and Management			3%	
123	Management and Sustainability of Forest Resources			1%	
131	Alternative Uses of Land			2%	
134	Outdoor Recreation			7%	
202	Plant Genetic Resources			2%	
205	Plant Management Systems			1%	
206	Basic Plant Biology			4%	
311	Animal Diseases			7%	
315	Animal Welfare/Well-Being and Protection			14%	
605	Natural Resource and Environmental Economics			17%	
607	Consumer Economics			3%	
608	Community Resource Planning and Development			16%	
609	Economic Theory and Methods			4%	
610	Domestic Policy Analysis			4%	
723	Hazards to Human Health and Safety			7%	
	Total			100%	

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

1. Situation and priorities

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

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

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

Support for remaining rural industries, such as agriculture, commercial fisheries, and tourism is an important mission of the experiment station.

2. Scope of the Program

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

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

1. Assumptions made for the Program

Funding will stay the same; staffing levels will stay the same; continued decline in natural-resource-based industries; continued interest in tourism; continued development pressure.

2. Ultimate goal(s) of this Program

To increase the sustainability of Maine's rural communities

V(E). Planned Program (Inputs)

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

Year	Extension		Research	
	1862	1890	1862	1890
2014	0.0	0.0	6.0	0.0
2015	0.0	0.0	6.0	0.0
2016	0.0	0.0	6.0	0.0
2017	0.0	0.0	6.0	0.0
2018	0.0	0.0	6.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

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

Extension	
Direct Methods	Indirect Methods

3. Description of targeted audience

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

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of other publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Improve knowledge of, or strategies and tools for, sustaining Maine's rural economies and communities
2	Adoption of strategies/tools for sustaining Maine's rural economies and communities
3	Enhance sustainability, diversity, and resiliency of Maine's rural economies and communities

Outcome # 1

1. Outcome Target

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

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 111 - Conservation and Efficient Use of Water
- 131 - Alternative Uses of Land
- 134 - Outdoor Recreation
- 202 - Plant Genetic Resources
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 315 - Animal Welfare/Well-Being and Protection
- 605 - Natural Resource and Environmental Economics
- 608 - Community Resource Planning and Development
- 723 - Hazards to Human Health and Safety

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

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

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 111 - Conservation and Efficient Use of Water
- 131 - Alternative Uses of Land
- 134 - Outdoor Recreation
- 202 - Plant Genetic Resources
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 315 - Animal Welfare/Well-Being and Protection

- 605 - Natural Resource and Environmental Economics
- 608 - Community Resource Planning and Development
- 723 - Hazards to Human Health and Safety

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Enhance sustainability, diversity, and resiliency of Maine's rural economies and communities

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 111 - Conservation and Efficient Use of Water
- 131 - Alternative Uses of Land
- 134 - Outdoor Recreation
- 202 - Plant Genetic Resources
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 315 - Animal Welfare/Well-Being and Protection
- 605 - Natural Resource and Environmental Economics
- 608 - Community Resource Planning and Development
- 723 - Hazards to Human Health and Safety

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect 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.)

Description

{NO DATA ENTERED}

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

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. 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.