

PLAN OF WORK

**MAINE AGRICULTURAL AND FOREST
EXPERIMENT STATION**

UNIVERSITY OF MAINE

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**Federal Fiscal Years
2000 to 2004**

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INTRODUCTION

This document represents the Plan of Work for the Maine Agricultural and Forest Experiment Station (MAFES) for the period FY2000 to 2004. In accordance with the Agricultural Research, Extension, and Education Reform Act of 1998 (AREERA), it describes the research activities of MAFES for the next five years. This Plan of Work pertains only to the Maine Agricultural and Forest Experiment Station. The University of Maine Cooperative Extension (UMCE) is submitting a separate Plan. However, the Plans of Work for UMCE and MAFES are consistent in terms of the processes that are/will be used to obtain stakeholder input and plans for future integration of research/extension activities.

Overview of the State

The provisions of the Hatch Act are based on the premise that the experiment stations are in the best position to identify and address the basic and applied research needs of their respective states in the areas of agriculture, forestry, marine and rural economic development. The University of Maine System Board of Trustees concurs with this view and has declared “that the Experiment Station has central responsibilities in the state for research in agriculture, marine, forest resources, and rural economic development.”

Based on its stated mission of conducting research for the people of Maine, this Plan of Work reflects the economic and cultural composition of Maine. Maine’s economy is highly dependent on the natural resources that lie within its borders. The agriculture, forestry, and aquaculture and marine industries are all mainstays of the Maine economy. For example, the forestry-related sectors contribute an estimated \$5.5 billion to the economy, and agriculture-related industries contribute another \$1.5 billion.

Although a good estimate of the economic contribution of the aquaculture and marine sector is not available, it easily exceeds \$1.0 billion. The land and water resources also attract millions of tourists each year who contribute about \$3.0 billion to the state economy. Furthermore, the people of Maine have maintained a close relationship with the resource base of the state. They are interested in protecting the resource base while ensuring that it be used in productive and sustainable ways.

More than 80 percent of Maine’s land base is forested. Most of the 17.7 million acres of forestland is privately owned, with about half of it owned by small wood lot owners and the other half owned by large industrial forest companies. Even though a large share of the land base is in forest, it is generally accepted that current harvesting levels can not be sustained over the long term. The answer to this problem does not lie in converting more land to forests; rather, it lies in improving the productivity of the existing forest land base. MAFES has the opportunity and responsibility to perform research that will enhance the overall productivity of Maine’s forestland and thereby ensure that future wood and fiber needs can be satisfied. McIntire-Stennis formula funds are used to conduct this research, and it is beyond the scope of this Plan of Work.

Maine's agricultural sector also faces challenges. Broilers, eggs, dairy, and potatoes, the traditional agricultural products, continue to be important commodities. However, potato acreage has continued to decline in recent years, as has the number of dairy farms. Broiler and egg production is highly concentrated and is no longer directly supported by research at the Experiment Station. Vegetable, wild blueberry, and nursery and greenhouse production are expanding in the state. Integrated pest management and other environmentally sustainable practices are in high demand by farmers.

Historical farm trends seem to be changing as well, as fewer farms are being lost and existing farms are not growing in size. This partially reflects a trend toward more diversified farming in Maine. Farmers are now growing a greater variety of crop and livestock products rather than specializing in one or two commodities. Many are also seeking opportunities to expand value-added processing, both on and off the farm. Maine also is moving toward a bimodal distribution of farm size, with more large commercial operations and a greater number of smaller, highly diversified farms, many of which are part-time farms. These trends give rise to a wide array of research issues for the Experiment Station.

Like its counterparts, the aquaculture and marine industry is also in transition. The ground fish fishery is threatened with collapse and other important natural fisheries, including lobster, are at risk. This is creating severe economic adjustment in some coastal communities. On the other hand, aquaculture operations are expanding and offer promise for the future. In fact, aquaculture is one of the five largest "agricultural" industries in Maine, based on the value of sales. Salmon and shellfish are the most common species being farmed; however, the feasibility of aquaculture for ground fish is being investigated. As in any animal operation, large concentrations of fish in confined spaces create potential health problems, such as the spread of viruses and other fish diseases. Issues related to selecting suitable sites for aquaculture operations and appropriate anchoring methods for the pens within Maine's large tidal fluctuations are also problems to be resolved if the industry is to continue to grow.

All sectors of the natural resource based industries are important to the state. However, sustaining these industries will require collaborative effort by the industries, the Experiment Station, Cooperative Extension, and other interested parties. Applied research is critical to the survival of these industries and the Experiment Station is committed to helping these industries retain their economic viability in Maine.

Description of Organizations Referenced in Plan of Work

In the body of the MAFES Plan of Work, reference is made to three organizations that play a role in complying with selected components of the Plan of Work. They are the MAFES Research Council, the University of Maine Board of Agriculture (UMBOA), and the Maine Agricultural Center (MAC). Each of these organizations is described briefly to explain their origin and functions as they relate to the Plan of Work requirements.

The MAFES Research Council was formed in the early 1980s to oversee the process of development of MAFES research projects by faculty with MAFES appointments. In addition to administrative support, the Research Council consists of four senior faculty with Experiment

Station appointments who have exemplary research records. The four faculty review, evaluate, and provide oversight for all Experiment Station projects (Hatch, McIntire-Stennis, and Animal Health) developed by faculty. The research council review process is described in detail in the “Scientific Peer Review of Experiment Station Projects” section of the Plan of Work. The Research Council will continue to provide oversight for reviewing projects to fulfill the requirement for scientific peer review of experiment station research projects.

The University of Maine Board of Agriculture was created by the Maine Legislature in 1998 to provide advice “on matters concerning the operation and management of agricultural research conducted by the Maine Agricultural and Forest Experiment Station” and on the agricultural-related programs of the University of Maine Cooperative Extension. Most of the nineteen members of the Board represent major farm organizations and commodity groups in Maine. This Board has met three times in the last six months and is one of the conduits through which MAFES is gathering input from agricultural stakeholders.

The Maine Agricultural Center was formed in January 1999 in response to the recommendations of an Agricultural Task Force created by the Chancellor of the University of Maine System. One of the responsibilities of the Center is to increase the level of cooperation and coordination between MAFES and UMCE. Better coordination will not only improve the delivery of services to stakeholders, it will also assist both MAFES and UMCE expand integrated research/extension activities during the next five years. Hence, the Center will assume leadership for increasing the level of integration between agricultural research and extension activities in Maine during the life of this Plan of Work. The Maine Agricultural Center will also play an important role in collecting agricultural stakeholder input over the next five years.

PLANNED PROGRAMS

The Maine Agricultural and Forest Experiment Station received \$1,755,914 in Hatch funds (including multi-state Hatch funds) for fiscal year 1999, with a required match of \$1,755,914, giving a total baseline of \$3,511,828 to allocate to MAFES planned programs. In determining the resources allocated to program areas, we have chosen to include other funds available to MAFES. The financial resources reported under each program description include Hatch funds, state appropriations, industry support, state and federal grants and contracts, other grants, and money generated by farm and timber product sales. This provides us with a total of approximately \$6,900,000 for these planned program areas, thereby demonstrating that the federal funds are being effectively matched. Because some of the funds we are allocating vary from year to year, it is difficult to project future allocations. We generally believe that all our major funding sources will be relatively constant over the next five years, To this end, we have let the funding allocations remain flat in our allocations tables, while adjusting the scientist years to reflect anticipated changes.

	Goal 1	Goal 2	Goal 3	Goal 4
Function				
1862 Research	Program 1.1,1.2	Program 2.1	Program 3.1	Program 4.1, 4.2, 4.3

Goal 1: An Agricultural System That Is Highly Competitive in the Global Economy

Maine farmers are stewards of 1.42 million acres of land. The agricultural system in Maine, consisting of production and food-processing industries, directly contributes more than \$1 billion annually to the state's economy and further stimulates the economy by associated banking, transportation, retail, and service activity. Natural resources are central to the export-based economy. Maine's unique geographic properties with 4,500 miles of tidal coastline, glacial soils and a northern climate ideal for growing a number of plants and crops and yet containing a land base that is nearly 90 percent forested, offer unique challenges. Potatoes, blueberries (Maine's wild blueberry crop is the largest in the nation), lobsters, and specialty food products are all exported to other states and throughout the world. Farming systems must meet market demands for high-quality products and allow agricultural products to be produced profitably, while preserving environmental quality and the health and safety of Maine's people.

Program Area 1.1: Plant-based Agricultural Production Systems

Issue(s):

Maine's short growing season, glacial soils, and cold climate make the state an ideal place to conduct research on the effects of these characteristics on a number of plant species. Also, as global climate change leads to more erratic winters characterized by thaw-freeze cycles in the absence of snow cover, plants of all varieties may be subjected to greater freeze damage. Landscape trees and plants, turf grass for golf courses, small fruit and vegetable crops, Maine's 64,000 acres of potato fields and a blueberry industry that produces over half of the world's wild blueberries are subject to the benefits and risks of this unique topography and climate. Thus, research on plant and turf hardiness, methods of propagation and conservation of native herbaceous plants, improvement of soil and fertility management of crops, and ways to develop a better understanding of the effects of cold climate on plant-based agricultural production systems is an important thrust of the Maine Agricultural and Forest Experiment Station.

In order to remain competitive, we must assure that we produce high-quality crops. Identifying and treating diseases that strike these crops is another important issue that Maine faces. Despite their hearty dinner plate image, potatoes are vulnerable to pests, insects, and diseases. One major pest incident, such as the late blight outbreaks in 1993 and 1998, can cause millions of dollars in crop losses. Applied research on disease affecting Maine's other major crop, the lowbush blueberry, is vital to assure that that \$100 million industry remains vibrant.

Boosting profits for Maine's agricultural producers is critical. Providing grower support, disease and pest prevention strategies, varietal research and new harvesting management techniques are important to the economic health of Maine. As consumer buying preferences change, economists in the Station must be ready to help producers remain viable. Research is need to help industries, such as the potato industry, identify consumer attitudes and determine which changes to products, marketing actions, or pricing strategies will result in greater market share. Growers, restricted by the amount of acreage available for production, are looking for ways to increase profitability, not by increasing the volume of product produced, but by adding value to the product.

Maine's economic future also depends in large part on the successful formation, continuation, and expansion of small businesses. The World Wide Web is rapidly changing consumer buying habits. Gaining knowledge about the demographic characteristics and purchasing preferences of consumers who visit Web-based food sites is an important direction for Maine's food producers because of the potential to allow small start-up firms in rural areas to reach potential customers worldwide with minimal costs.

Performance Goal(s):

- C Improve soil and fertility management in potato, blueberry, and other crops, ranging from fine-tuning fertilizer needs to improving soil quality with organic amendments
- C Develop a better understanding of the effects of cold climate on a range of cropping systems including blueberries, potatoes and other small fruits and vegetables, turf grass and deciduous woody ornamentals
- C Develop strategies and techniques for controlling disease in fruit and vegetable cropping systems while reducing reliance on chemical pesticides and fertilizers
- C Develop improved varieties for agriculture via conventional breeding and biotechnology
- C Develop value-added food products through research involving innovative processing technologies using Maine agricultural products
- C Marketing research to examine production costs, consumer preferences, and marketing opportunities for existing Maine commodities and potential new products

Output Indicators:

- C New varieties of plants and development of value-added products
- C Understanding of virulence of plant pathogens
- C Improved cold-weather tolerance of plants and grasses

Outcome Indicators:

- C Success of the programs will be determined by the successful adoption of new products, varieties, processes, and marketing strategies in Maine's potato, blueberry, aquaculture, and specialty food producer sectors
- C State and federal agencies use of soil, water, and fertility management practices

Key Program Component(s):

- C Analysis of food and drink marketing on the Internet
- C Fruit and vegetable supply-chain management, innovations, and competitiveness
- C Managerial aspects of the potato industry
- C Physiology and culture of the lowbush blueberry

- C Integrated turf grass management for environmental enhancement and resource conservation
- C Rootstock and interstem effects on pome and stone fruit trees
- C Development of new potato clones for environmental and economic sustainability in the Northeast
- C Physiological studies on plant growth and tuber development in the potato
- C Optimizing resistance of potato tubers to bacterial infection
- C Regulation of virulence in *R. solani*
- C Research on diseases of lowbush blueberry

C Propagation of native herbaceous plants for commercial uses and natural conservation

Plans for Reporting Outcomes:

The outcomes from this program area will be reported in CRIS AD421 Progress Reports, the national impact database, the MAFES impact database, and in various Station publications and joint Station/Cooperative Extension publications, as well as reported in presentations by the faculty and the director to stakeholder groups.

Internal and External Links:

Collaboration for this research occur with Cooperative Extension, producer groups, private firms, state and federal agencies, other universities, and other non-governmental agencies

Target Audience:

Target groups for the research outputs include producer groups, private firms, state and federal agencies, and non- governmental organizations

Program Duration:

Long term. This program of fifteen projects will extend for the five- year life of this plan.

Allocated Resources: [SY]

Current	FFY 2000	FFY 2001	FFY 2002	FFY 2003	FFY 2004
[5.12] \$1,200,000	[6.22] \$1,200,000	[7.22] \$1,200,000	[7.22] \$1,200,000	[7.22] \$1,200,000	[7.22] \$1,200,000

The financial resources reported here include Hatch funds, state appropriations, industry support, state and federal grants and contracts, other grants, and money generated by farm and timber product sales.

Program Area 1.2: Animal-based Agricultural Production Systems

Issue(s):

For animal-based agricultural production systems to be competitive in the global economy, Maine farmers must adopt new management and production techniques that will increase productivity and lower costs. Improvement of forage quality and utilization, regulation of nutrient use in food producing animals, and understanding factors that control reproduction that will provide methodologies for improving reproduction are among the research areas that will help Maine producers.

Finding ways to produce healthy, genetically superior animals is an issue of concern and importance. Genetic engineering is one more tool that cutting edge scientists are using to improve crop plants, animals, and fish species. Prevention of animal and fish diseases, methods to determine sex of embryo and ways to overcome infertility in valuable dairy cattle are some of the issues that the Experiment Station can address through genetic engineering and selective breeding. There is increasing demand for equine research by the horse industry in Maine,

particularly those who raise Standardbreds. Research in infertility and assisted reproduction for horses is a new direction for scientists in the Station.

In addition to the traditional farm-based animal production systems, management of Maine commercial fisheries is vital if Maine is to be competitive. Maine leads the nation in the development of new commercial fisheries management approaches, i.e., the lobster zones. Maine lobster, central to the state's cachet and recognized throughout the world, must be healthy and accessible to markets beyond Maine and New England's borders. We need to develop new markets for marine species and products from Maine's emerging aquaculture industry whose landing are currently valued at \$60-\$65 million annually. Scientists in the Station must continue to find ways to manage its wild fisheries resources as well as develop the specific methods by which aquaculture can be economically and environmentally pursued. Numerous and important local wild stocks of cod and haddock have been lost in the last few decades. Research on culturing these species in their early life can bring restoration of wild stocks and commercial culturing of both species close to economic viability. Development of equipment, systems, and techniques in response to the specific needs of Maine's marine resource-related industries are also needed to help maintain or improve the competitiveness of these industries. In many cases, this means the continuation of traditional ways of life and economic viability for Maine's coastal communities.

Performance Goal(s):

- C Develop and utilize livestock and fish genetic resources
- C Develop new marketing opportunities and value-added processing techniques
- C Determine impacts of public policy on the health of Maine's animal farming and fishing communities
- C Develop high-tech applications for animal health
- C Engineering research and development for agricultural fisheries production, processing and shipping

Output Indicators:

- C Cost effective, quicker methods for identifying fish viruses
- C Lobster feed developed from shellfish byproducts
- C A noninvasive and accurate method to identify female dairy cattle embryos prior to their sale or embryo transfer
- C Better understanding of changes in the dairy industry in Maine
- C Design of technologies for fish processing plants

Outcome Indicators:

- C Industry use of sophisticated fish- and lobster-processing methods and
- C Quicker, more cost effective methods of identifying fish viruses
- C Economically healthier dairy farms

Key Program Component(s):

- C Development of aquacultural and fisheries production and processing technologies
- C Impacts of structural change in the dairy industry
- C Maine/New England commercial fisheries management

- C Physiology and growth of marine fish early life history stages
- C Investigating nutrition and feeding management of marine fish at differing life stages
- C Improvement of forage quality and utilization with biological additives
- C Nutrition and health maintenance for the lobster industry
- C Regulation of nutrient use in food-producing animals
- C Association of fertility with temporal changes in ovarian function of domestic ruminants
- C Utilization of crustacean processing by-products
- C Health management strategies for the bivalve culture industry of Maine
- C Molecular diagnostic assays and genetic characterization of fish viruses
- C Population and quantitative genetics of commercially valuable marine bivalves
- C Developing tools for controlling infectious salmon anemia virus (SAV)

Plans for Reporting Outcomes:

The outcomes from this program area will be reported in CRIS AD421 Progress Reports, the national impact database, the MAFES impact database, and in various Station publications and joint Station/Cooperative Extension publications, as well as reported in presentations by the faculty and the director to stakeholder groups.

Internal and External Links:

Collaboration for this research occur with Cooperative Extension, producer groups, private firms, state and federal agencies, other universities, and other non-governmental agencies

Target Audience:

Target groups for the research outputs include producer groups, private firms, state and federal agencies and non-governmental organizations

Program Duration:

Long term. This program of 18 projects will extend for the five-year life of this plan.

Allocated Resources: [SY]

Current	FFY 2000	FFY 2001	FFY 2002	FFY 2003	FFY 2004
[8.58] \$2,140,000	[9.43] \$2,140,000	[9.93] \$2,140,000	[9.93] \$2,140,000	[9.93] \$2,140,000	[9.93] \$2,140,000

The financial resources reported here include Hatch funds, state appropriations, industry support, state and federal grants and contracts, other grants, and money generated by farm and timber product sales.

Goal 2: To Provide a Safe, Affordable, and Nutritious Food Supply

Program Area 2.1: Food Safety and Quality

Issue(s):

Maine is obviously a net food importer, yet food production and processing is important in several key sectors: dairy, fisheries, potatoes, and blueberries, and other fruits and vegetables.

Food safety in these areas is an important concern to producers and consumers. Researchers in the Maine Agricultural and Forest Experiment Station are working on fruit- and seafood-handling and processing technologies. These technologies are aimed at extending shelf life of product and preventing food-borne risks. For example, the presence of *E. coli* in fruit juices poses a potentially serious health problem. A system to sample, to concentrate, and to deliver the juice matrix to a biosensor for detection of *E. coli* is needed to help processors provide the public with a safe and secure food delivery system.

The health and environmental attributes of products have become increasingly important to consumers. Firms have responded by placing claims on product labels that highlight the product's health and environmental attributes, and by introducing new or redesigned products. Governments and non-governmental organizations have also responded by organizing, implementing, and verifying labeling programs that cover thousands of products in more than 20 countries. In the near future, certification and disclosure programs may be standardized across the world (under current ISO 14020 negotiations). Although implementation of labeling programs is widespread, research concerning their impact and effectiveness is limited and aggregate quantitative results are rare, particularly with respect to environmental food safety labeling.

Performance Goal(s):

- C Develop technologies and methods to assure access to a safe food supply for Maine people

Output Indicators:

- C Design of a delivery system for the detection of *E. coli* in fruit juices
- C Development of a benefit estimation method that relies on observed (grocery store scanner data) rather than stated behavior to measure the market and welfare impacts providing nutrient information
- C Immunoassay methods to rapidly analyze certain fungicides in processed foods

Outcome Indicators:

- C Safer food supply
- C Nutritional labeling that will inform the public without adversely affecting the economic well being of food producers

Key Program Component(s):

- C Technologies for foodstuff quality assurance
- C Technology and principles for assessing and retaining post harvest quality of fruits and vegetables
- C Economic research developing effective health, environmental, and pricing disclosure
- C Nutrient composition of food and chemical safety evaluation of water, soil, and food

Plans for Reporting Outcomes:

The outcomes from this program area will be reported in CRIS AD421 Progress Reports, the national impact database, the MAFES impact database, and in various Station publications and joint Station/Cooperative Extension publications, as well as reported in presentations by the faculty and the director to stakeholder groups.

Internal and External Links:

Collaboration for this research occur with Cooperative Extension, producer groups, private firms, state and federal agencies, other universities, and other non-governmental agencies

Target Audience:

Target groups for the research outputs include producer groups, private firms, state and federal agencies and non- governmental organizations

Program Duration:

Long term. This program of five projects will extend for the five-year life of this plan.

Allocated Resources: [SY]

Current	FFY 2000	FFY 2001	FFY 2002	FFY 2003	FFY 2004
[2.75] \$360,000	[2.75] \$360,000	[3.25] \$360,000	[3.25] \$360,000	[3.25] \$360,000	[3.25] \$360,000

The financial resources reported here include Hatch funds, state appropriations, industry support, state and federal grants and contracts, other grants, and money generated by farm and timber product sales.

Goal 3: To Achieve A Healthier, Better Nourished Population

Program Area 3.1: Human Nutrition

Issue(s):

A particular concern in Maine is the nutrition of elders and the young in society and these are two thrusts of the MAFES research efforts in this area. In the United States, one million adolescents suffer from anorexia nervosa and bulimia nervosa. Morbidity and mortality rates in anorexia nervosa alone are among the highest recorded for psychiatric disorders. It is during youth that individuals acquire and consolidate eating patterns and develop lifelong attitudes toward eating. Adolescents, particularly young women, are vulnerable to developing eating disorders, yet we know little about the development of these pathologies. Research is needed to understand the cause of such disorders before nutrition education programs can be developed to assist adolescents in dealing with their problems.

At the other end of the spectrum, are the elderly. Currently, 13 percent of Americans are age 65 and over. By the year 2010, Maine Census projections predict at least a 33 percent increase in people aged 55 to 85 or older. Quality of life, particularly nutrition issues, for the elderly population in Maine is important as Maine's population ages and more seniors are living into their eighties and beyond. In fact, the fastest growing segment of seniors is sometimes called the old-old, those over 85. We have insufficient data to understand the food intake patterns of elderly Maine citizens and thus nutritional quality of their diets. To gain this knowledge, we need to evaluate dietary intake methods and screening protocols to identify nutritional risk in the elderly

and we need to determine biochemical indicators of nutritional status as predictors of chronic disease in the elderly.

Another growing area of concern for Maine's older population is the problem of osteoporotic bone fractures, most common in postmenopausal women. The current recommendation for calcium intake in women age 50-70 years is 1200 mg calcium per day. To achieve this level of intake, women need to take three to four eight-ounces of milk per day. Experience has shown that many people are not receptive to consuming that much milk on a regular basis. Alternative sources of dietary calcium are needed to allow more choices for the consumer, and thus ensure that this population of women achieves optimum health.

Performance Goal(s):

C Improve nutrition for all Maine people, especially the elderly and teen population

Output Indicators:

- C Better understanding of nutritional status of elderly men and women
- C Development of a "stages of change" model to promote consumption of grains, vegetables, and fruits by young adults
- C Development of a "Fear of Eating" attitude scale

Outcome Indicators:

C Development of a knowledge base that can be used by clinicians, cooperative extension, public school administrators and teachers, and social service agencies to develop improved interventions and educational programs.

Key Program Component (s):

- C Stages of change model to promote consumption of grains, vegetables and fruits by young adults
- C Assessment of nutritional risk in the elderly
- C Efficacy of crab byproduct as an alternative calcium supplement in postmenopausal women
- C Trace minerals and atherosclerosis

Plans for Reporting Outcomes:

The outcomes from this program area will be reported in CRIS AD421 Progress Reports, the national impact database, the MAFES impact database, and in various Station publications and joint Station/Cooperative Extension publications, as well as reported in presentations by the faculty and the director to stakeholder groups.

Internal and External Links:

Collaboration for this research occur with Cooperative Extension, private firms, state and federal agencies, other universities, hospitals, public school systems, and other non-governmental agencies

Target Audience:

Target groups for the research outputs include hospitals, public schools, private firms, state and federal agencies, Cooperative Extension, the legislature, and non-governmental agencies

Program Duration:

Long term. This program of five projects will extend for the five-year life of this plan.

Allocated Resources: [SY]

Current	FFY 2000	FFY 2001	FFY 2002	FFY 2003	FFY 2004
[1.52] \$270,000	[1.82] \$270,000	[1.82] \$270,000	[1.82] \$270,000	[1.82] \$270,000	[1.82] \$270,000

The financial resources reported here include Hatch funds, state appropriations, industry support, state and federal grants and contracts, other grants, and money generated by farm and timber product sales.

Goal 4: Greater Harmony Between Agriculture and the Environment

In many ways, Maine people define their quality of life in terms of environmental quality. Indeed, economic development strategies for Maine historically have begun from the premise that quality of life is the foundation on which all else is built. At the same time, natural resources are the driving force behind most of Maine’s export-based industries—paper, wood products, potatoes, blueberries, and seafood. The way in which these natural resources are used and conserved has a tremendous impact on the environmental quality by which Maine people measure their well-being. As a result of these twin forces, research in virtually every department in the experiment station addresses the interface between natural resource utilization and environmental quality.

Program Area 4.1: Soil and Water Quality

Issue(s):

The issues of soil and water quality are very important to the people of Maine. The purity of these resources enhances the state’s recreational appeal and gives it a unique aesthetic appeal known throughout the world.

Maine is a state rich in water resources. It includes more than 4,500 miles of coastline, 6,000 lakes and ponds, and 32,000 miles of rivers and streams. These waters not only support a \$273 million commercial finfish and shellfish industry they also provide Mainers with an ample water supply and sustain forests and wildlife. Over the past 20 years, water quality in Maine has increased dramatically because of efficient detection and regulation of point sources of pollutants. Research concerning further enhancement of water quality in Maine is needed to assess the effects and sources of non-point pollution. Non-point pollution of streams is usually associated with urban or agricultural land use, and is often manifested by increases in levels of nutrients and other pollutants (e.g., pesticides).

Soil quality is vitally important to the productivity of Maine’s forestry and agriculture industries. It also has impacts on water quality. In addition, in 1989 the Maine State Legislature established the statewide goal of recycling 50% of the municipal solid waste. This goal reflected the need to

address Maine's solid waste disposal crisis, which grew from increased disposal costs and decreasing available landfill capacity. Municipal composting of the organic matter waste will help the state reach this goal. Research, therefore, is needed to develop cropping systems that reduce erosion and leaching while improving soil health, to develop sustainable fertilizer recommendations, which would save the producer money and help reduce the pollution of surface waters, to design large-scale composting systems that minimize negative effects on soil and water quality, and to develop new value-added composted products to help the growing composting industry.

MAFES conducts other research in these areas, but the projects are funded through the McIntire-Stennis Act and do not fall under the scope of this document.

Performance Goal(s):

- \$ Enhance soil quality and productivity, while utilizing locally available resources, such as animal and green manures, and developing environmentally compatible farming methods
- \$ Improve both surface- and groundwater quality as a way to improve overall health of Maine people and the wildlife and recreational resources of the state

Output Indicators:

- \$ Best management practices for composting facilities
- \$ Sensitive bioassessment methods for measuring the health of rivers and streams
- \$ Sustainable fertilizer recommendations
- \$ New, value-added products from composted materials

Outcome Indicators:

- \$ Reduced pollution of ground- and surfacewater from agricultural and nonpoint sources in Maine
- \$ Greater reliance by Maine producers on nonchemical soil amendments
- \$ Reaching the state-mandated goal of a 50% reduction in solid waste
- \$ More productive composting industry in the state

Key Program Component(s):

- \$ Long-term response of freshwater resources (particularly wetlands) to climate change and effect of land use patterns on the biodiversity of freshwater habitats
- \$ Effects of nonpoint pollution and road salt on the structure and function of freshwater ecosystems
- \$ Improved soil nutrient management systems
- \$ Soil chemical and biological processes as indicators of soil quality
- \$ Economics of waste management
- \$ Best management practices for preventing water quality impacts from composting facilities and value-added products from composted materials

Plans for Reporting Outcomes:

The outcomes from this program area will be reported in CRIS AD421 Progress Reports, the national impact database, the MAFES impact database, and in various Station publications and joint Station/Cooperative Extension publications, as well as reported in presentations by the faculty and the director to stakeholder groups.

Internal and External Linkages:

Collaborations for this research occur with Cooperative Extension, producer groups, private firms, municipalities, state and federal agencies, other universities, and non-governmental organizations.

Target Audiences: Target groups for the research outputs include state and federal agencies, municipalities, producer groups, private firms, and non-governmental organizations.

Program Duration: Long term. This program of nine projects will extend for the five-year life of this plan.

Allocated Resources [SY]

Current	FFY 2000	FFY 2001	FFY 2002	FFY 2003	FFY 2004
[4.55] \$890,000	[4.55] \$890,000	[5.55] \$890,000	[5.55] \$890,000	[5.55] \$890,000	[5.55] \$890,000

The financial resources reported here include Hatch funds, state appropriations, industry support, state and federal grants and contracts, other grants, and money generated by farm and timber product sales.

*Program Area 4.2: Pest Management***Issue(s):**

Management of an agricultural system involves manipulation of the plant and/or animal life within the farm and can cause major shifts in the ecology of the surrounding landscapes. An agricultural system needs to provide adequate income to farmers and farm workers while having minimal negative impacts on surrounding communities and the environment. The Maine Agricultural and Forest Experiment Station, a recognized leader in integrated pest management research, is developing new practices that are safe for the environment, farm workers, and the public. A particular focus of the Pest Management program area at the Maine Agricultural and Forest Experiment Station is on controlling the pests of wild blueberries and potatoes, two of Maine's leading crops.

Potato production has been one of the leading agricultural products in Maine for decades. Once a healthy and growing sector of the farm economy, the potato industry has suffered many setbacks in recent years. Both state and federal regulations on the chemicals farmers may use are increasing. In addition there is growing concern about the negative impact of current farming practices on soil productivity and the increased pesticide resistance of key regional agricultural pests.

Wild blueberry is the third most important agricultural crop in Maine, and Maine produces 80% of the wild blueberries grown in the U.S. for the world market. Blueberry production is the major industry in Washington County, one of the poorest counties in Maine, with an unemployment

rate more than double the 1999 statewide average. Reducing pesticide and herbicide inputs in blueberry production is a priority in the state of Maine, since synthetic chemical pesticides and herbicides can lead to ground water pollution, local loss of biodiversity, increased production costs, and human health concerns. Use of pesticides and herbicides can also affect the availability of native pollinators. As the cost of honey bee pollination services continues to rise, blueberry growers (and other growers who rely on insect pollination in Maine) need ways to ensure a sustainable and economically viable supply of pollinators. Providing the research answers needed to implement integrated weed and pest management programs will allow wild blueberry growers to retain their 25% share of the North American blueberry crop.

Performance Goal(s):

- \$ Develop effective and affordable pest management strategies for Maine producers, including biorationale/biointensive approaches, as a means of promoting profitability, food safety, worker health, and environmental protection

Output Indicators:

- \$ Computer-based pest management models
- \$ Best management practices for herbicides used in blueberry production
- \$ Strategies for optimizing availability of native insect pollinators

Outcome Indicators:

- \$ Reduced reliance on chemical pesticides and herbicides by Maine growers
- \$ Reduced expenditures on pollination services in Maine

Key Program Component(s):

- \$ Physiological and behavioral responses of beetle species to plant allelochemicals and use of entomopathogens as a management strategy in IPM systems
- \$ Effects of herbicide use on beneficial insects
- \$ Interactions among soil fertility, plant quality, pest control practices, and the performance of potato pests and natural mortality factors
- \$ Economic and policy analyses of the potato cropping systems, including sensitivity analyses
- \$ Computer-based models for insect pest management
- \$ Weed management practices in wild blueberry fields that will reduce potential intrusion of pesticides into ground water

Plans for Reporting Outcomes:

The outcomes from this program area will be reported in CRIS AD421 Progress Reports, the national impact database, the MAFES impact database, and in various Station publications and joint Station/Cooperative Extension publications, as well as reported in presentations by the faculty and the director to stakeholder groups.

Internal and External Linkages: Collaborations for this research occur with Cooperative Extension, the Passamaquoddy Tribe, producer groups, private firms, state and federal agencies, other universities, and non-governmental organizations.

Target Audiences: Target groups for the research outputs include state and federal agencies, producer groups (mainly the blueberry and the potato industries), private firms, and non-governmental organizations.

Program Duration: Long term. This program of seven projects will extend for the five-year life of this plan.

Allocated Resources [SY]

Current	FFY 2000	FFY 2001	FFY 2002	FFY 2003	FFY 2004
[3.17] \$1,310,000	[3.17] \$1,310,000	[3.97] \$1,310,000	[3.97] \$1,310,000	[3.97] \$1,310,000	[3.97] \$1,310,000

The financial resources reported here include Hatch funds, state appropriations, industry support, state and federal grants and contracts, other grants, and money generated by farm and timber product sales.

Program Area 4.3: Fish, Wildlife, and Other Natural Resources

Issue(s):

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 Experiment Station’s mission to provide the research necessary to conserve and preserve these resources. The state has a wide diversity of research needs: enhancing the quality of the inland fishery resource, finding solutions for potential clashes between wildlife and development or commercial uses, and determining public preferences for land use are but a few. While some of this MAFES research is conducted with Hatch funds, much of it is conducted using McIntire-Stennis funds. The research described here is only that funded through the Hatch Act.

Performance Goal(s):

\$ Develop the technologies, the understanding of wildlife biology and habitat needs, and the public policy strategies so that the use of natural resources in Maine can remain sustainable

Output Indicators:

- \$ Better understanding of fish genetics and diseases
- \$ Greater understanding of public preferences for land use
- \$ Greater recognition of habitat needs of vulnerable wildlife species

Outcome Indicators:

- \$ Reduction of farmed salmon predation by harbor seals
- \$ Statewide land use policy in sync with public preferences
- \$ Sustainable development policies in Maine

Key Program Component(s):

- \$ Role of harbor and grey seals in the coastal gulf of Maine ecosystem
- \$ The non-market values of environmental resources
- \$ Impacts of natural resource development on wildlife species conservation

Plans for Reporting Outcomes:

The outcomes from this program area will be reported in CRIS AD421 Progress Reports, the national impact database, the MAFES impact database, and in various Station publications and joint Station/Cooperative Extension publications, as well as reported in presentations by the faculty and the director to stakeholder groups.

Internal and External Linkages: Collaborations for this research occur with Cooperative Extension, producer groups, private firms, state and federal agencies, other universities, and non-governmental organizations.

Target Audiences: Target groups for the research outputs include producer groups, private firms, state and federal agencies, and non-governmental organizations.

Program Duration: Long term. This program of 11 projects will extend for the five-year life of this plan.

Allocated Resources [SY]

Current	FFY 2000	FFY 2001	FFY 2002	FFY 2003	FFY 2004
[3.8] \$730,000	[4.1] \$730,000	[4.1] \$730,000	[4.1] \$730,000	[4.1] \$730,000	[4.1] \$730,000

The financial resources reported here include Hatch funds, state appropriations, industry support, state and federal grants and contracts, other grants, and money generated by farm and timber product sales.

STAKEHOLDER INPUT PROCESS

As required by the Guidelines for State Plans of Work, this section describes the process through which stakeholder input will be obtained over the life of the Plan of Work. The requirement for stakeholder input applies to not only Hatch formula funds and its required match, but also McIntire-Stennis and Animal Health formula funds and their required match. The procedures described below for collecting stakeholder input apply to all types of formula funds, unless noted otherwise. The following is a listing of the methods that will continue to be used or will be initiated to obtain stakeholder input over the next five years.

- To fulfill its legislative responsibility to advise MAFES and UMCE on agricultural research and extension needs, the Board of Agriculture, in conjunction with UMCE and MAFES is currently in the process of collecting stakeholder input from agricultural stakeholders. All known agricultural groups in Maine have been contacted by the Board of Agriculture and asked to indicate their research and extension needs by July 15, 1999. Forestry and the aquaculture and marine groups have not been contacted as the Board of Agriculture responsibility only pertains to agriculture, as narrowly defined. Once obtained, the input received from the agricultural groups will be used to develop a long-range plan for research and extension programs of the University. The Board will also work with the University and Maine Legislature to secure additional funding for research and extension if existing funding levels are insufficient to meet existing and future needs of agriculture.
- MAFES Faculty will continue to be used to identify future research needs. Most faculty interact with stakeholder groups and individual growers/producers in both formal and informal settings. They present research results to agricultural groups and receive feedback on current research and needs for additional research. Faculty also interact with their peers at the regional, national and international level and discuss current and future research needs with them. They also attend conferences where research is presented and future research needs are discussed. The faculty represent the strength of the MAFES research program and their input is crucial to it.
- MAFES and UMCE will jointly sponsor a series of listening sessions in Maine during the period covered by this Plan of Work. These will be scheduled in all areas of the state and will be widely publicized to attract as many participants as possible. Notices in newspapers, radio and television announcements, letters to agricultural organizations, and extension contacts will be used to encourage participation.
- The Maine Agricultural Center and MAFES will continue to work closely with agricultural, forestry and marine groups on a continuing basis to ensure that the needs of the stakeholders are understood and addressed. These efforts will be both formal and informal and range from well-established stakeholders (such as the Maine Potato Board and the Wild Blueberry Commission of Maine) to newly emerging groups (such as the Maine Cranberry Growers and the Women in Agriculture Network). The Maine Agricultural Center will assume responsibility for this, thereby ensuring an integrated research/extension approach.

- MAFES participated with the Agricultural Council of Maine in the development of a business plan for Maine agriculture. The Maine Agricultural Center is also participating in the implementation of the plan and in establishing priorities for implementation. This business plan identifies key needs of the industry that transcend commodity groups. Examples of these needs include business training for farmers and processors, environmentally sustainable and economically profitable production methods, value-added processing and expanded marketing opportunities, and land use/tax policies that do not disadvantage farmers. The Experiment Station and the Maine Agricultural Center will continue to work with the Agricultural Council of Maine to develop specific needs related to research.
- Advisory groups will continue to be used by the Experiment Station to obtain information about current research needs. In addition to the Board of Agriculture, there are two forestry advisory groups—the Forest Resources Advisory Committee and the Cooperative Forestry Research Unit Advisory Committee. The former committee represents a cross section of forestland owners in Maine, while the latter is composed of larger industrial forestland owners. These committees provide direct input on research priorities to the Experiment Station and its faculty, and offer feedback on projects proposed by faculty within the Experiment Station. Currently, there is no advisory committee for the aquaculture and marine industry. This industry is very diverse and not well organized, which makes it difficult to form a representative committee. However, such a committee is needed and will be developed during the life of this Plan of Work.
- One of the advantages of a closer working relationship between MAFES and UMCE to be accomplished through the Maine Agricultural Center is improved communication between researchers and extension faculty. This will facilitate the flow of information from the University to stakeholders and vice versa. Hence, extension agents and specialists will become a more accessible source of research needs for the Experiment Station researchers.

As the Experiment Station expands its effort to elicit stakeholder input, special effort will be made to identify and invite underrepresented groups and individuals. The newly formed Women in Agriculture Network and other agriculture, forestry and aquaculture groups will be asked to help identify underrepresented groups. The Experiment Station has already identified some underrepresented groups that have not been served in the past, such as the equine and other parts of the livestock industry. MAFES has already taken steps to initiate research programs for this diverse group. Overall, the Station will make every effort to allow all groups and individuals to express their suggestions and concerns about station-sponsored research through the mechanisms discussed above. All stakeholder input processes shall be open, fair, and accessible to all groups. All participants will be treated with dignity and respect.

SCIENTIFIC PEER REVIEW OF EXPERIMENT STATION PROJECTS

The Agricultural Research, Extension, and Education Reform Act of 1998 requires that all Experiment Station projects funded through Hatch formula funds be subjected to a scientific peer review process. This scientific review process must include an “evaluation by experts with scientific knowledge and technical skills to conduct the proposed work whereby the technical quality and relevance to the program goals are addressed.” In the early 1980s, the Maine Agricultural and Forest Experiment Station established a scientific peer review process for all new and revised projects funded by the Experiment Station through Hatch, McIntire-Stennis, and Animal Health formula funds. The MAFES Research Council takes leadership for the review process. This process is described in this section to comply with the Plan of Work requirements.

As in any research organization, the Maine Agricultural and Forest Experiment Station (MAFES) relies upon its faculty to develop research projects and programs that address priority needs. Priority research areas are identified through a number of sources, including the expertise of researchers, department and station administrators, external advisory groups, regional and national research planning committees, and various forms of stakeholder input. The University of Maine Board of Agriculture and the Forest Resources Advisory Committee are particularly important in identifying priority areas.

Each September, new MAFES faculty and current faculty whose MAFES projects terminate a year hence begin the process of developing a MAFES research project. The faculty are encouraged to consult with their unit administrators, faculty colleagues, client groups, and members of the Research Council to identify priority research areas.

In the first formal step, scientists developing a new or revised research project prepare a preproposal. The preproposal includes a brief description of the proposed objectives, time schedule, a justification for the proposed research based on established research priorities and stakeholder input, and an overview the scientific and technological value of the proposed project. Scientists seeking to participate in a new or revised *Multi-State Research Project* also prepare a preproposal for review by the Research Council. This preproposal contains all of the elements outlined above for a Hatch or McIntire-Stennis project, *plus* a discussion of the expected benefits from participation in multi-state research.

The scientist provides copies of his or her preproposal and the results of an USDA Current Research Information System (CRIS) search to the Research Council for review. Then, a meeting is scheduled between the Research Council, the scientist, and the scientist’s unit administrator to discuss the proposed research. For those who have a project that is terminating, accomplishments of the previous project as well as plans for future research are discussed. All preproposals are also distributed to the University of Maine Board of Agriculture and the Forest Resources Advisory Committee, whose members are invited to comment on the relevance of the proposed research.

Following the meeting with the Research Council, the scientist and unit administrator are informed of the Research Council’s decision regarding the preproposal. When the Research Council does not accept the preproposal, it may ask that a new preproposal be developed or that

the current preproposal be revised and resubmitted to the Research Council. Another meeting may be scheduled between the Research Council, the scientist developing the preproposal, and his or her unit administrator.

Once the preproposal receives Research Council approval, the scientist prepares a full research proposal and a member of the Research Council is appointed to serve as “oversight” for the faculty member preparing the proposal. The oversight person works with the scientist and closely monitors the development of the full research proposal.

When the full proposal is completed, four external peer reviewers are selected to review the proposal. These reviewers are selected from a list of potential reviewers submitted by the scientist who developed the proposal, from suggestions offered by Research Council members, and from scientists identified through a CRIS search. Care is taken to ensure that the chosen reviewers have the expertise to provide a thorough review of the scientific methods proposed for the study, the overall quality of the proposal, and the importance of the research based on current research priorities. In almost all instances, the reviewers chosen also conduct research similar to that being described in the proposal. Each reviewer is asked to complete a rating sheet provided by the Research Council, and to provide additional comments on the proposal.

Upon receipt of the external reviews, anonymous copies of the rating sheet and comments are forwarded to the scientist’s unit administrator to discuss with the scientist. The Research Council oversight person also receives copies of these materials. The scientist is asked to prepare a final proposal, taking into consideration the peer reviewers’ comments. The scientist developing the proposal also must submit a letter outlining all of the substantive peer reviewers’ comments and the scientist’s response to these comments, along with the final proposal.

After the oversight member of the Research Council has had an opportunity to review the final proposal, a meeting of the full Research Council is scheduled. The oversight person discusses the final proposal, reviewers’ comments, and how the comments have been incorporated into the final proposal. The Oversight person also makes a general recommendation to the Research Council as to whether the final proposal should be accepted. The Research Council makes a final evaluation of the revised proposal, taking into consideration the reviewers’ comments and the scientist’s responses and revisions. The Research Council recommends approval of the proposal to the Director of the Maine Agricultural and Forest Experiment Station, or returns the proposal to the scientist with suggestions and requests resubmission. When approved by the Research Council, the Director of the Maine Agricultural and Forest Experiment Station submits the proposal and required forms to the United States Department of Agriculture, Cooperative State Research, Education, and Extension Service for final approval.

As previously noted, this process of peer review of all Experiment Station projects has been used for over 15 years and has improved the quality of the proposals and, more importantly, the quality of the research conducted by MAFES faculty. This process will continue to be used in the future to satisfy the peer review requirement that has been integrated into the Plan of Work.

MULTI-STATE RESEARCH PROJECTS

The Maine Agricultural and Forest Experiment Station is currently participating in 16 multi-state research projects. More than 25% (\$511,865) of our Hatch funding is spent on these multi-state,

multi-disciplinary projects. Participation in multi-state projects provides an efficient means of gathering data and transferring information by tapping into the individual expertise at participating experiment stations. The sum of efforts generated by individual stations combine to produce a greater whole. Regional projects are also interdisciplinary in nature, giving the project a full spectrum of expertise that assures an integrated approach to the problem being researched.

For Maine, participation in regional projects is of particular importance. Unlike some of the larger stations, the Maine Agricultural and Forest Experiment Station often has only one or two faculty with expertise in a specific area. Through regional participation, an individual faculty member from Maine can share his or knowledge and gain expertise from others in the discipline to enhance the quality of research provided to the people of Maine.

We believe responsibility for scientific peer review for research programs funded under section 3(c)(3) of the Hatch Act (commonly referred to as Hatch Multi-State Research Funds) is at the regional level. All Maine Agricultural and Forest Experiment Station scientists who wish to participate in a regional project must propose science that is relevant and that meets one or more of the objectives as determined by the participating scientists, the administrative advisor and the CSREES administrative advisor assigned to the project.

Current	FY2000	FY2001	FY2002	FY2003	FY2004
\$511,865	\$511,865	\$511,865	\$511,865	\$511,865	\$511,865

List of MAFES Multi-State Projects

ME08817	NC-140	Schupp, J.	Rootstock and Interstem Effects on Pome and Stone Fruit Trees
ME08550	NC-219	White, A.	Stages of Change Model to Promote Consumption of Grains, Vegetables, and Fruits by Young Adults
	NE-9	Zhang, D.	Conservation and Utilization of Plant Genetic Resources*
ME08310	NE-148	Wallace, C.	Regulation of Nutrient Use in Food Producing Animals
ME08312	NE-161	Weber, J.A.	Association of Fertility with Temporal Changes in Ovarian Function of Domestic Ruminants
ME08559	NE-172	Cook, Rosen	Assessment of Nutritional Risk in the Elderly
ME08202	NE-177	Smith, S.	Impacts of Structural Change in the Dairy Industry
ME08103	NE-179	Donahue, D.	Technology and Principles for Assessing and Retaining Postharvest Quality of Fruits and Vegetables
ME08805	NE-184	Porter, Reeves	Development of New Potato Clones for Environmental and Economical Sustainability in the Northeast
	NE-186	Kornfield, I.	Genetic Maps of Aquaculture Species*
ME08232	S-222	Criner, Cheng	Fruit and Vegetable Supply-Chain Management, Innovations, and Competitiveness
ME08801	S-265	Groden, E.	Development and Integration of Entomopathogens into Pest Management Systems
ME08208	S-278	Cheng, H. T.	Food Demand and Consumption Behavior
	NSRP-4	Yarborough, D	A National Agricultural Program to Clear Pest Control Agents for Minor Uses
ME08904	NE-3	Fernandez, I.J	The National Atmospheric Deposition Program (NADP)

*Participation begins October 1, 1999.

We also participate in less formal multi-state activities through sponsored research activity and through programs and activities including the Maine/New Hampshire Sea Grant program that provides support, leadership, and expertise for marine research, education and extension in northern New England. Hatch funds help support faculty who conduct research at the Darling Marine Center, a research facility serving the marine interests of faculty, staff, students and visiting investigators from around the world. The annual Potato Conference draws upon expertise from potato growing regions across the country. In return, Station researchers provide scientific expertise to extension staff and to researchers in several other states.

Accomplishments reporting on our multi-state, multi-disciplinary, and integrated activities for our Station will be through the annual Northeast impact statements and the Northeast results reported through institutionally integrated AD-421s. Financial statements on expenditures will come from this station as AD-419s.

INTEGRATION OF RESEARCH AND EXTENSION ACTIVITIES

Currently, the programs of the Maine Agricultural and Forest Experiment Station and the University of Maine Cooperative Extension are not well integrated. The two units are not closely linked administratively, as the Director of each unit reports to the University Provost. Furthermore, internal and external factors have moved the two organizations in different directions over the last two decades. Although it is difficult to estimate the level of integration that currently exists, probably less than ten percent of the research conducted with Hatch funds is integrated with extension activities in a meaningful way. However, steps are currently being taken that will reverse that trend and bring the Experiment Station and Cooperative Extension closer together again, especially in the programs related to agriculture. Below is listing of some of the steps that will be taken over the next five years to improve the integration of research and extension activities that are funded by the Hatch and the Smith-Lever Acts. The goal is to more than double the level of integrated research and extension activities over the next five years.

As noted in the introduction, one of the objectives of the Maine Agricultural Center is to integrate research and extension activities related to agriculture. The industry is expecting this integration to take place and will monitor progress through the University of Maine Board of Agriculture. The Maine Agricultural Center will achieve the integration through several approaches.

- Currently only five faculty have joint appointments in the Experiment Station/College and Cooperative Extension. The Maine Agricultural Center will be responsible for increasing the number of agriculture-related joint appointments between the two units. This will be accomplished in two ways: current research and extension faculty appointments will be analyzed; opportunities to place selected faculty on joint appointments will be evaluated from the standpoint of the individual, the Experiment Station, and Cooperative Extension. New positions in the College/MAFES and UMCE also will be evaluated for their potential as joint appointments. It is believed that the number of joint appointments between MAFES and

UMCE can be increased significantly through these efforts over the next five years. This will help ensure that research and extension activities are more closely integrated.

- The Maine Agricultural Center will also work toward integration by facilitating and enhancing communication between Cooperative Extension faculty/professionals and MAFES faculty. Currently, communications between the two groups is uneven and largely driven by the efforts of individual faculty rather than by design. The Maine Agricultural Center will ensure that the two groups are communicating on a regular basis and that each group is aware of the activities of the other.
- The Maine Agricultural Center will also provide incentives for integrated research/extension activities. This will be accomplished by giving priority to integrated projects when providing additional funds for agriculture-related activities that are a high priority for the industry.
- As MAFES faculty develop new or revised Hatch projects, they will be asked how their proposed projects relate to ongoing or planned extension programs and activities. Jointly planned and jointly funded projects will be encouraged when appropriate. Extension faculty will be encouraged to serve as co-principle investigators on those projects that are jointly planned and jointly funded.
- The MAFES will also integrate its outreach and communications efforts with UMCE. For example, the Experiment Station and Cooperative Extension will jointly sponsor open houses at Experiment Station farms, conferences, seminars and field days. Faculty from both units will participate in these events. Joint publications, such as impact statements and “brag” sheets will also be developed. As noted in the section on stakeholder input, the gathering of stakeholder input by the two organizations will also be integrated during the next five years. Integration at the staff level will demonstrate that the administrations of UMCE and MAFES are serious about integrating the activities of the two units.

POINT OF CONTACT

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Certification:

_____	_____
Dr. G. Bruce Wiersma	Date
Dean, College of Natural Sciences, Forestry, and Agriculture and Director, Maine Agricultural and Forest Experiment Station	

APPENDIX A—LIST OF HATCH PROJECTS BY PROGRAM AREA

Goal 1 An Agricultural System That Is Highly Competitive in the Global Economy

Program Area 1.1: Plant-based Agricultural Production Systems

ME08100	Hedstrom, W.	Water Requirements And Management For Selected Maine Crops
ME08108	Christensen, T.	Machinery Development For The Bio-Resource Industries
ME08203	Leiby, J. D.	Managerial Aspects Of The Potato Industry
ME08232	Criner, Cheng	Fruit And Vegetable Supply-Chain Management, Innovations, And Competitiveness
ME08305	Smagula, JM	Physiology And Culture Of The Lowbush Blueberry
ME08313	Langille, A.	Physiological Studies on Plant Growth and Tuber Development in the Potato
ME08402	Vayda, M.	Optimizing Resistance Of Potato Tubers To Bacterial Infection
ME08451	Tavantzis, S.	Regulation of virulence in <i>R. solani</i> .
ME08805	Porter, Reeves,	Development Of New Potato Clones For Environmental And Economical Sustainability In The Northeast
ME08807	Langille, A.	Integrated Turfgrass Management For Environmental Enhancement And Resource Conservation
ME08809	Lambert, DH	Applied Research on Diseases of Lowbush Blueberry
ME08817	Schupp, J.	Rootstock And Interstem Effects On Pome And Stone Fruit Trees
***	Annis S.L.	Diversity and Infection Strategies of Pathogens of Lowbush Blueberry
***	Manley, R. C.	Winter Hardiness and Root Freezing Tolerance of Deciduous Woody Ornamental Plants
***	Zhang, D.	Propagation of Native Herbaceous Plants for Commercial Uses and Natural Conservation

Program Area 1.2 Animal-based Agricultural Production Systems

ME08101	Riley, J.	Engineering R & D For Aquacultural And Fisheries Production, Processing, And Shipping
ME08202	Smith, S.	Impacts Of Structural Change In The Dairy Industry
ME08210	Wilson, J.	Maine/New England Commercial Fisheries Management
ME08302	Hunt von Herbing	The Physiology And Growth Of Marine Fish Early Life History Stages
ME08303	Kling, L.	Studies Investigating Nutrition And Feeding Management Of Marine Fish At Differing Life Stages
ME08306	Stokes, M.R.	Improvement Of Forage Quality And Utilization With Biological Additives
ME08308	Bayer, R.	Nutrition And Health Maintenance For The Lobster Industry
ME08310	Wallace, C	Regulation Of Nutrient Use In Food Producing Animals
ME08312	Weber, J.A.	Association of Fertility with Temporal Changes in Ovarian Function of Domestic Ruminants
ME08315	Causey, R.	Epithelial-bacterial Interactions in the Equine Uterus
ME08556	Skonberg, D.	Utilization of Crustacean Processing By-Products
ME08307	Barber, B. J.	Health Management Strategies For The Bivalve Culture Industry Of Maine
ME08750	Nicholson, BL	Molecular Diagnostic Assays And Genetic Characterization Of Fish Viruses
ME08754	Singer, J. T.	Genetically Engineered Bivalent Vaccine Against Vibriosis And Aquatic Birnaviruses

- *** Van Beneden, R.J. Contaminant Effects in Early Life Stages of Finfish and Shellfish
- *** Kornfield, I. Genetic Maps of Aquaculture Species
- *** Rawson, P. Population and Quantitative Genetics of Commercially Valuable Marine Bivalves
- *** Anderson, E. Infectious Salmon Anemia Virus (ISAV): Molecular Tools for the Control of an Emerging Viral Pathogen

Goal 2—A Safe and Secure Food and Fiber System

Program Area 2.1: Food Safety/Quality

- ME08102 Donahue, D., et al. Technologies For Foodstuff Quality Assurance
- ME08103 Donahue, D. Technology And Principles For Assessing And Retaining Postharvest Quality Of Fruits And Vegetables
- ME08205 Teisl, M. Economic Research Developing Effective Health, Environmental, and Pricing Disclosure
- ME08211 White, G. Analysis Of Food And Drink Marketing On The Internet
- ME08208 Cheng, H.T. Food Demand And Consumption Behavior
- ME08555 Bushway, Bushway Nutrient Composition Of Food And Chemical Safety Evaluation Of Water, Soil, And Food

Goal 3—A Healthy, Well-nourished Population

Program Area 3.1: Human Nutrition

- ME08550 White, A. Stages Of Change Model To Promote Consumption Of Grains, Vegetables, And Fruits By Young Adults
- ME08552 Camire, M.E. New Advancements In Consumer Testing
- ME08558 Klimis, D. Trace Minerals and Atherosclerosis
- ME08559 Cook, Rosen, Assessment Of Nutritional Risk In The Elderly
- *** Sullivan, S. The Efficacy of Crab Byproduct as an Alternative Calcium Supplement in Postmenopausal Women

Goal 4—Greater Harmony Between Agriculture and the Environment

Program Area 4.1: Soil/Water Quality

- ME08106 Seymour, R. M Hydrologic Properties Of Alternative Potato Production Systems And Manure/Yard Waste
- ME08140 Reeve, A.S. Interaction of Road Salt with Environmental Systems in Maine
- ME08201 Criner, G. Waste Management Economics And Policy
- ME08454 Davis, Anderson, Understanding Biology-Chemistry-Hydrology Relationships In Maine Peatlands
- ME08802 Porter, Sisson Refinement Of Soil And Nutrient Management Systems For Potato Cropping Systems
- ME08803 Hurn, A. D. Land Use, Functional Integrity And Bioassessment Of Headwater Streams In Maine
- ME08808 Ohno, T. Mechanisms Of Legume-Derived Allelochemical Interactions With Soil Solution And Surfaces
- ME08814 Erich, M. S. Soil Chemical And Biological Processes As Indicators Of Soil Quality
- ME08904 Fernandez, IJ The National Atmospheric Deposition Program (NADP)

Program Area 4.2: Pest Management (Sustainable Agriculture)

ME08452	Ringo, J.M.	Assessing the Behavioral Effects of Chemicals in the Control of Aphids
ME08461	Lambert, DH	Effects Of Sustainable Crop Management Systems On Potato Early Dying
ME08506	Alford, A. R.	Adult Beetle Responses To Plant Allelochemicals
ME08507	Drummond, F	Impact Of Herbicides On Beneficial Insects Associated With Blueberry And Cranberry
ME08801	Groden, E.	Development And Integration Of Entomopathogens Into Pest Management Systems
ME08806	Yarborough, D.	Weed Management In Wild Blueberries And Upland Cranberries
ME08912	Porter, et al.	Ecological Pest And Soil Management Systems For Potatoes In Maine

Program Area 4.3: Fish, Wildlife and other Natural Resources

ME08206	Boyle, et al.	Benefits And Costs Of Resource Policies Affecting Public And Private Land
ME08403	Vayda, Cashion,	Teleost Fish Myoglobin: Structure And Stability
ME08450	Schwintzer, C.	Physiology and Ecology of Frankia and Actinorhizal Plants
ME08456	Campbell, C	Evolutionary Studies Of Amelanchier (Shadbush), Picea (Spruce), And Betula papyrifera (White Birch)
ME08458	Chivers, D.	Chemical Alarm Signals and Learned Predator Recognition by Salmonid Fishes
ME08459	Vadas, et al.	Impact Of Rockweed Harvests On The Habitat Value And Recruitment Potential Of Ascophyllum nodosum
ME08660	Gilbert, J. R.	Role Of Harbor And Grey Seals In The Coastal Gulf Of Maine Ecosystem
ME08661	Rhymer, J.	Hierarchical Population Genetic Structure Of Rare Species Using The Wood Turtle As A Model
ME08662	Servello, FA	Population and Habitat of Ecology of Terns in Maine
***	Kim, C.	Development of a Zebrafish Model for Disease

***Start date of October 1, 1999.