

# 2010 University of New Hampshire Research Plan of Work

**Status: Accepted**  
**Date Accepted: 05/29/09**

## I. Plan Overview

### 1. Brief Summary about Plan Of Work

The New Hampshire Agricultural Experiment Station (NHAES) resides within the University of New Hampshire College of Life Sciences and Agriculture. It has responsibility for Hatch, McIntire-Stennis, Animal Health, and Multistate Research Programs. This Annual Report does not include New Hampshire Cooperative Extension, which is a separate administrative unit. However, there is effective coordination of relevant programs between the two units. Through the COLSA Agriculture Strategic Planning Committee and the NHAES Advisory Committee, we are working to facilitate constituent input, to focus our resources on priority issues and to improve our delivery of research findings to end users. Our intent over the next five years is to strategically prioritize expenditures to maximize efficiency and productivity, and strongly move toward a smaller set of focused research emphases in which we intend to excel. The goal of our planned programs is to provide both fundamental and applied research in support of state and regional agricultural issues, and which will lead to enhanced production, marketing and processing of regional agricultural products. We inform our activities with knowledge of agricultural production in New Hampshire and the region. Based on the most recent data available from the USDA's New England Agricultural Statistics Service, the number of NH farms increased 24% since the last census in 2002, from 3,363 to 4,166. The most growth came in farms with less than \$100,000 in annual sales. Land in farms also increased, rising six percent to 471,911 acres. This means more land has been returned to production. However, the trend continues to be more farms of smaller size; average farm size shrank by 14% over the last five years, from 132 to 113 acres. Farm numbers grew nationally, too, but at only one-sixth of New Hampshire's rate of growth. Market value of agricultural production in NH grew 37% to over \$199 million, and was nearly balanced between crop and livestock sector sales, at 53% and 47% respectively. NH ranked very high nationally in several key NASS agricultural metrics. With 173 organic farms, we were first in the nation for value of organic as percent of total sales. We were number two nationally in percent of farms with female principle operators, and number three in the nation for percent of agricultural sales from direct marketing. Finally, NH was number three nationally in percent of total value of agricultural sales from direct sales. These statistics provide incentive to, and are consistent with, our strategies to emphasize these and related aspects of integrated agriculture, natural resources, and food health and safety that are important to NH and New England, in how we prioritize our research projects and expenditures. Our research and teaching programs will both emphasize sustainable agriculture and food systems, and will contribute to the development of a highly competitive and sustainable agricultural system for local, regional and global markets. The NH Agricultural Experiment Station supports multiple basic and applied projects to create knowledge and technology for the benefit of the state, region and nation. We believe these projects provide valuable results, and excellent return on the investment of taxpayer funds through federal and state contributions. The research findings, developments and technologies will continue to be transferred through myriad mechanisms including classroom, laboratory and field instruction, stakeholder workshops, a variety of publication formats, presentations at local, regional, national and international scientific and stakeholder meetings, websites, web portals and genomic data banks, technology transfer, policy recommendations, and other venues.

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

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	23.1	0.0
2011	0.0	0.0	23.1	0.0
2012	0.0	0.0	23.1	0.0
2013	0.0	0.0	23.1	0.0
2014	0.0	0.0	24.0	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 University Panel
- Combined External and Internal University External Non-University Panel
- Expert Peer Review
- Other (Peer review of proposals, manuscripts and products )

**2. Brief Explanation**

The New Hampshire Agricultural Experiment Station has conducted a formal peer review process to evaluate proposed research projects for over seventeen years. The process applies to all Planned Programs. Each fall a letter is sent to eligible faculty in the College of Life Sciences and Agriculture and to Deans of other Colleges announcing a competition for Hatch and McIntire-Stennis funds, including Hatch-Multistate projects. Faculty are encouraged to submit a one page description of their proposed project and to meet with the AES Associate Director to discuss the work. If the proposed project is determined to fit within the guidelines for support, the faculty member is encouraged to develop a full proposal using standard USDA format. Faculty must suggest five potential external peer reviewers who are not at UNH and have no perceived conflict of interest with the PI. The Associate Director identifies at least two anonymous external reviewers based on these suggestions and/or their own investigation of suitable persons. After the external reviews are returned to the Station, the faculty member is provided an opportunity to revise the proposal and/or prepare rebuttal comments based on the review comments. The next step in the process is to again critically review all submitted proposals using an internal panel of six representative faculty members plus the Associate Director, and taking into account also the completed external reviewer evaluations and the PI responses to these. From this, the committee develops a prioritized list recommended for potential approval. The AES Director and Associate Director use this recommendation and their own independent evaluation to make the final decision as to which projects the Experiment Station will fund. Usually about 80% of the proposals submitted are forwarded to CSREES/USDA for their ultimate approval of funding. We recently modified this procedure in response to stakeholder input, and the criteria used for proposal evaluation are included in the call for proposals sent out each year. The criteria include: 1) Relationship to the Hatch, McIntire-Stennis, and/or Hatch-Multistate programs, and to the NHAES mission and research priorities; 2) Scientific and technical merit; 3) Soundness of approach, procedures and methodology; 4) Likelihood of significant contributions and/or innovative advances; 5) Previous and current research productivity and accomplishments [or potential, for new investigators]; and 6) Likelihood of significant enhancement in research capability and competitiveness [particularly but not exclusively for Research Development projects].

**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?**

The UNH College of Life Sciences and Agriculture (COLSA) is working to develop an Agricultural Strategic Plan (ASP) to

facilitate the integration of agricultural research, teaching and outreach programs. The ASP Committee collected input from an exhaustive list of internal and external stakeholders from the state and region. The methods included direct meetings and listening sessions, workshops and site visits. The college and NHAES have internal advisory committees, and both are developing effective new external advisory committees, that meet on a regular basis. Input from these and many additional sources are used in the development and updating of priority areas for NHAES research. These priorities are described in the annual RFP for NHAES project proposals. The Director's Office and faculty researchers maintain connection to critical issues through multiple professional contacts with varied stakeholders and with priorities expressed by funding entities, regional and national policies, and additional means.

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

Under-served and under-represented populations of the state are being identified as part of the NHAES prioritization process and the college's strategic planning activities. A proactive approach is being established to actively encourage project proposals that address these groups. Examples include strengthening our ongoing efforts to increase the availability and intake of healthy foods, to promote viability of local products and markets, and to ensure that our stakeholder venues include and encourage participation by under-served and under-represented groups.

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

The principle investigators of all NHAES projects are asked to complete annual web-based Plan of Work questionnaires. Several questions address the expected outcomes of their individual projects. The expected outcomes statements from individual projects are synthesized into a summary of expected outcomes for each planned program. Investigators report actual outcomes in their annual reports (AD-421) and portions of this information is also summarized for each planned program in the station Research Annual Report. In general, changes in knowledge related to individual projects are described to stakeholders through publications (peer reviewed and otherwise), workshops, presentations at scientific and public meetings, websites and traditional media (radio, television, newspapers), and other venues. For many research projects, quantitative and often substantive qualitative outcomes are difficult to accurately assess, as they develop incrementally over time, and neither the scientists nor stations have effective means to obtain unambiguous information from many of the important stakeholders. Therefore we generally report only the small subset of actual outcomes which are within our abilities to assess, or that we become aware of. Selected changes in condition and in action can sometimes be described for applied research projects. For example, if a breeding program develops a new variety of more nutritious and better quality product and the variety is produced by a seed company, a measurable change in condition might be the availability of that variety to growers. A change in action might be that producers decide to grow it. These outcomes can be described, but are difficult to accurately quantify. Changes in condition and actions from many research activities frequently take time to fully mature, and the nature of knowledge dissemination makes them very difficult to assess or quantify.

## **4. How will the planned programs result in improved program effectiveness and/or efficiency?**

We are simultaneously undertaking substantive changes in the nature of research funding to strongly support and enhance productive research, and to develop more cohesive programmatic thrusts where we can utilize our relative strengths in order to provide significant advances. Scientists who do not use taxpayer funds in a productive manner will no longer be supported. We are in the midst of a comprehensive evaluation of our research facilities that includes efficiency and effectiveness of staffing, feeding operations, allocations, and other aspects. Our shared goal is to provide the greatest possible outcome within the constrained resources available to us.

## **IV. Stakeholder Input**

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

- Targeted invitation to non-traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of traditional stakeholder groups
- Other (Comments from proposal and manuscript reviewers)
- Targeted invitation to non-traditional stakeholder individuals
- Survey of selected individuals from the general public
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups

**Brief explanation.**

Input to help establish program priorities is encouraged by multiple means, including presentations and meetings with traditional and non-traditional stakeholder groups. Traditional stakeholders are generally very interested in the work done by the NHAES and are most willing to offer input and suggestions on what the AES can do that would help them. In most cases, the only action required is to meet with them or contact them in some other way. Input from stakeholders in individual NHAES projects is encouraged in a wide variety of ways including surveys (telephone, in person, and web-based), through presentations at scientific conferences, through educational workshops, through multistate project meetings, via mass media, through publications, through the university classroom and educational programs aimed at K-12. Nontraditional stakeholders are being increasingly engaged to inform and assist in our efforts to increase emphasis on sustainable agricultural and food systems research. Many of these folks are highly interested and supportive.

**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**

- Open Listening Sessions
- Other (UNH Cooperative Extension)
- Needs Assessments
- Use Internal Focus Groups
- Use Advisory Committees

**Brief explanation.**

The NHAES is a core participant in the college's ongoing strategic process to reinvigorate agricultural research, instruction and engagement. Stakeholder input is sought to help shape and strengthen the future of our agricultural programs. UNH Cooperative Extension, the NH Department of Agriculture and the college and NHAES advisory committees have been extremely helpful in identifying traditional and non-traditional stakeholders. Meetings with groups of stakeholders generally result in identification of additional stakeholder groups. Attendance and presentations at agricultural exhibitions, such as the annual NH Farm & Forest Expo, facilitate direct conversations with a very diverse group of stakeholders. Listening to and speaking with participants in field days and open houses, and Extension sponsored conferences and workshops provides insights from grower groups, professionals, government agencies, home gardeners and many others.

**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 specifically with non-traditional individuals
- Survey of selected individuals from the general public
- Meeting with invited selected individuals from the general public
- Meeting specifically with non-traditional groups
- Meeting with traditional Stakeholder groups
- Meeting with the general public (open meeting advertised to all)
- Survey of traditional Stakeholder individuals
- Meeting with traditional Stakeholder individuals

### **Brief explanation**

For strategic planning and development of NHAES programs and priorities, input is collected primarily through meetings with stakeholder groups and individuals including growers, farmers, citizens, agricultural organizations and councils, natural resources professionals and managers, state and federal agency representatives, neighboring state AES administrators, research project directors, graduate and undergraduate students, the AES internal and external advisory committees and so forth. While most meetings are open discussions, some are presentations followed by questions and answer sessions. The NHAES administration also attends many Cooperative Extension workshops and meetings and takes advantage of these opportunities to participate in discussion with groups and individuals. The College of Life Science and Agriculture and NHAES are completely overhauling the Agriculture and Research sections of the college website to make agriculture much more prominent, visible and accessible. NHAES research project participants obtain direct and indirect stakeholder input through varied avenues. Projects with social science components frequently use questionnaires and surveys. Stakeholder input to many basic science and some applied projects occurs in the form of reviewer inputs to proposals and manuscripts, and from questions, comments and discussions following presentations at regional, national and international conferences. Stakeholder input for some projects is collected through comments and questions at workshops and training sessions for end users.

### **3. A statement of how the input will be considered**

- In the Budget Process
- To Identify Emerging Issues
- In the Action Plans
- Redirect Research Programs
- To Set Priorities
- In the Staff Hiring Process
- Other (Strategic Initiatives Development)

#### **Brief explanation.**

Stakeholder input is used to continually review and update research priorities, relevant existing and emerging topics, and individual and programmatic performance. The information informs activities including faculty and staff hires, and investments to facilities and programs. Our strategies, activities and priorities are dynamic and evolve with consideration of stakeholder input, institutional and social goals, and additional factors.

**V. Planned Program Table of Content**

<b>S. NO.</b>	<b>PROGRAM NAME</b>
1	Agricultural Systems
2	Animals & Animal Products
3	Biotechnology & Genomics
4	Communities, Economics & Commerce
5	Food, Nutrition & Health
6	Natural Resources & Environment
7	Pest Management
8	Plants & Plant Products
9	Sustainable Horticulture
10	Sustainable Marine Aquaculture & Fisheries

**V(A). Planned Program (Summary)**

**Program #1**

**1. Name of the Planned Program**

Agricultural Systems

**2. Brief summary about Planned Program**

The overall goal of the program is to undertake a systems approach to agricultural research in order to better understand and facilitate its economic, environmental and social sustainability. We expect that fundamental agricultural practices as well as those involving related energy, environmental, marketing, social and other aspects will be included. We recently initiated a new research facility that is particularly well positioned to facilitate this work.

**3. Program existence :** Intermediate (One to 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
123	Management and Sustainability of Forest Resources			5%	
131	Alternative Uses of Land			10%	
133	Pollution Prevention and Mitigation			10%	
135	Aquatic and Terrestrial Wildlife			5%	
205	Plant Management Systems			5%	
305	Animal Physiological Processes			5%	
307	Animal Production Management Systems			15%	
311	Animal Diseases			5%	
315	Animal Welfare, Well-Being and Protection			5%	
401	Structures, Facilities, and General Purpose Farm Supplies			10%	
403	Waste Disposal, Recycling, and Reuse			10%	
601	Economics of Agricultural Production and Farm Management			5%	
608	Community Resource Planning and Development			10%	
	<b>Total</b>			100%	

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

#### 1. Situation and priorities

The renaissance in local food and farming in New England and its linkages with regional food systems and societal interests in maintaining environmental quality constitutes an important focal area. Relevant contributions to strengthened and viable sustainable agricultural systems in New England is a critical priority and one toward which we will direct significant resources. Core aspects include considering the integral roles of energy, waste treatment, resource use efficiency, and social goals for agricultural food, products and services.

**2. Scope of the Program**

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

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

**1. Assumptions made for the Program**

Growing consumer and societal desires for sustainable agricultural systems are important drivers of future viability. Success of regional agricultural enterprises will demand an ability to effectively address consumer interests in local, organic and specialty products, alignment with environmental and land use goals, and other efforts to ensure economic, environmental and cultural alignment and value. Understanding linkages between natural resources, agriculture and food systems is necessary and is optimally addressed through consideration of agricultural systems. Objective and unbiased research is a critical aspect in development of viable options to maintain a healthy agricultural sector.

**2. Ultimate goal(s) of this Program**

The ultimate goal of the program is to identify and address opportunities to align regional agriculture with consumer and social interests in order to increase options for success and enhanced quality of life for local and regional producers and citizens.

**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
2010	0.0	0.0	1.4	0.0
2011	0.0	0.0	1.4	0.0
2012	0.0	0.0	1.4	0.0
2013	0.0	0.0	1.4	0.0
2014	0.0	0.0	3.0	0.0

**V(F). Planned Program (Activity)**

**1. Activity for the Program**

There are currently two projects in this program, and we anticipate adding more. The first current project will investigate approaches to improve the economic and environmental sustainability of dairy enterprises. In vitro and in situ assays will quantify amino acid availability in distiller's grains, and in vivo assays will evaluate lysine and methionine as modifiers of rumen fermentation in lactating dairy cows. Data will be disseminated to researchers in ruminant nutrition, developers of ruminant nutrition software programs, and dairy nutritionists and farmers, via published manuscripts, conference presentations and

publications, and workshops and seminars. The project will also use the research dairy herd and laboratory analyses to study the effects of colostrum replacers, essential oils and pasturing on heifer and calf growth. The second project addresses development of seaweed culture methods to support sustainable integrated multi-trophic aquaculture systems in New England. The study will attempt to evaluate the species of seaweeds within different habitats in the Gulf of Maine, including pristine and stressed environments. In addition, sites of high incidence of introduced seaweeds will be identified in order to characterize the sources and vectors of these introductions. The study will aid in the management of valuable coastal resources plus minimize the introductions of non-indigenous seaweeds that can impact other economically important species. Species identity of cultures will be confirmed via DNA sequencing. Growth and nutrient uptake rates will be determined through lab measurements.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● Other 1 (Field and laboratory Research)</li> <li>● Education Class</li> <li>● Workshop</li> <li>● Demonstrations</li> <li>● Other 2 (Presentations at meetings)</li> </ul>	<ul style="list-style-type: none"> <li>● Web sites</li> <li>● Other 1 (Peer Reviewed Publications)</li> </ul>

**3. Description of targeted audience**

The target audiences include scientists, terrestrial and marine agricultural producers, resource managers; town, state and national commissions and agencies; nutritionists, feed consultants and companies, food producers and processors; students, citizens and consumers.

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons(contacts) to be reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	1000	2000	50	100
2011	50	100	50	100
2012	50	100	50	100
2013	50	100	0	100
2014	100	100	25	50

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

**Expected Patent Applications**

2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	2	0	2
2011	1	0	1
2012	1	0	1
2013	1	0	1
2014	2	0	2

**V(H). State Defined Outputs**

**1. Output Target**

- Number of participants in the project (not including audience counts)

2010 8                      2011 7                      2012 :7                      2013 7                      2014 7

- Number of undergraduate students directly involved in the projects

2010 3                      2011 3                      2012 :3                      2013 3                      2014 6

- Number of graduate student directly involved in the projects

2010 2                      2011 1                      2012 :1                      2013 1                      2014 3

- Number of university courses in which project results have been incorporated

2010 3                      2011 2                      2012 :2                      2013 2                      2014 3

- Number of presentation at regional, national, or international scientific meetings

2010 4                      2011 2                      2012 :2                      2013 2                      2014 2

- Number of reviewed publications including theses, abstracts, etc

2010 3                      2011 3                      2012 :3                      2013 3                      2014 3

- Number of peer-reviewed publications

2010 1                      2011 2                      2012 :2                      2013 3                      2014 3

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	Number of graduate students involved and trained
2	Increased knowledge through publications and other measures
3	Number of undergraduate students involved and trained
4	Increased knowledge about agricultural systems in support of management efforts

**Outcome #1**

**1. Outcome Target**

Number of graduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

**2010 :**1                      **2011 :** 1                      **2012 :** 2                      **2013 :** 2                      **2014 :**2

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 123 - Management and Sustainability of Forest Resources
- 133 - Pollution Prevention and Mitigation
- 135 - Aquatic and Terrestrial Wildlife
- 205 - Plant Management Systems
- 305 - Animal Physiological Processes
- 307 - Animal Production Management Systems
- 315 - Animal Welfare, Well-Being and Protection
- 401 - Structures, Facilities, and General Purpose Farm Supplies
- 403 - Waste Disposal, Recycling, and Reuse
- 601 - Economics of Agricultural Production and Farm Management

**Outcome #2**

**1. Outcome Target**

Increased knowledge through publications and other measures

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010 :**0                      **2011 :** 0                      **2012 :** 0                      **2013 :** 0                      **2014 :**0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 123 - Management and Sustainability of Forest Resources
- 133 - Pollution Prevention and Mitigation
- 135 - Aquatic and Terrestrial Wildlife
- 205 - Plant Management Systems
- 305 - Animal Physiological Processes
- 307 - Animal Production Management Systems
- 315 - Animal Welfare, Well-Being and Protection
- 401 - Structures, Facilities, and General Purpose Farm Supplies
- 403 - Waste Disposal, Recycling, and Reuse

**Outcome #3****1. Outcome Target**

Number of undergraduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure**2010** : 2**2011** : 2**2012** : 3**2013** : 3**2014** : 3**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 123 - Management and Sustainability of Forest Resources
- 131 - Alternative Uses of Land
- 133 - Pollution Prevention and Mitigation
- 135 - Aquatic and Terrestrial Wildlife
- 205 - Plant Management Systems
- 305 - Animal Physiological Processes
- 307 - Animal Production Management Systems
- 315 - Animal Welfare, Well-Being and Protection
- 401 - Structures, Facilities, and General Purpose Farm Supplies
- 403 - Waste Disposal, Recycling, and Reuse
- 601 - Economics of Agricultural Production and Farm Management

**Outcome #4****1. Outcome Target**

Increased knowledge about agricultural systems in support of management efforts

**2. Outcome Type :** Change in Knowledge Outcome Measure**2010** : 1**2011** : 1**2012** : 1**2013** : 1**2014** : 1**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 123 - Management and Sustainability of Forest Resources
- 131 - Alternative Uses of Land
- 133 - Pollution Prevention and Mitigation
- 135 - Aquatic and Terrestrial Wildlife
- 205 - Plant Management Systems
- 305 - Animal Physiological Processes
- 307 - Animal Production Management Systems
- 315 - Animal Welfare, Well-Being and Protection
- 401 - Structures, Facilities, and General Purpose Farm Supplies
- 403 - Waste Disposal, Recycling, and Reuse

- 601 - Economics of Agricultural Production and Farm Management

## **V(J). Planned Program (External Factors)**

### **1. External Factors which may affect Outcomes**

- Appropriations changes
- Competing Programmatic Challenges
- Economy
- Natural Disasters (drought, weather extremes, etc.)

#### **Description**

For any field research in agriculture, extreme or anomalous weather conditions or natural disasters can interfere with work, or produce atypical results that require changes in research methodology or direction. Change in the economy can change regional priorities and necessitate refocusing research. The success of the research is highly dependent on continued funding of NHAES at a sufficient level. Budgetary pressures mandate that competing programs be prioritized to maximize relevance and productivity.

## **V(K). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- Retrospective (post program)
- During (during program)

#### **Description**

Evaluation of work will be based on peer acceptance of outcomes including manuscripts and papers, and on perceived utility to and application of results by producers, educators, and students. Feedback will be obtained through established and new networks with those engaged in agricultural practices, interested stakeholders and citizens, scientists, managers and others.

### **2. Data Collection Methods**

- Unstructured
- Observation
- Journals
- Other (Feedback from stakeholders)
- Case Study

#### **Description**

Solicited and unsolicited feedback will be obtained from myriad stakeholders through formal and informal interactions including meetings and conferences, advisory groups, local and state government meetings or discussions, proposal and manuscript reviews, and other venues.

**V(A). Planned Program (Summary)**

**Program #2**

**1. Name of the Planned Program**

Animals & Animal Products

**2. Brief summary about Planned Program**

Planned research in this program includes efforts related to animal health, animal nutrition and growth, and animal reproduction. Investigations related to aquaculture are included in the Sustainable Marine Aquacultura & Fisheries Program. Continuing current projects include the following: Nucleotide Metabolism During Signal Transduction in Retinal Photoreceptor Cells, Regulation of Jagged 1 Expression in Adipogenic Cells by Insulin, Glucocorticoids and Phosphodiesterase Inhibitors, Management Systems to Improve the Economic and Environmental Sustainability of Dairy Enterprises, and Ovarian Influences on Embryonic Survival in Ruminants.

**3. Program existence :** Mature (More then 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
301	Reproductive Performance of Animals			25%	
302	Nutrient Utilization in Animals			15%	
303	Genetic Improvement of Animals			5%	
305	Animal Physiological Processes			20%	
307	Animal Production Management Systems			5%	
308	Improved Animal Products (Before Harvest)			5%	
311	Animal Diseases			10%	
315	Animal Welfare, Well-Being and Protection			10%	
723	Hazards to Human Health and Safety			5%	
	<b>Total</b>			100%	

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

#### 1. Situation and priorities

Animal-based products are an important aspect of agriculture in New Hampshire, New England, the nation and world. Research to help improve the efficiency, effectiveness, quality and viability of animal agriculture is critical in order to meet increasing demands for food, products and services. The main priorities through the NHAES are related to multiple aspects of organic and conventional dairy practices, animal reproduction, and health. Additional topics are supported according to perceived needs, opportunities, and abilities.

#### 2. Scope of the Program

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

**V(D). Planned Program (Assumptions and Goals)****1. Assumptions made for the Program**

Profitable dairy production requires optimal heifer growth. Optimizing calf nutrition will improve growth and therefore profitability by possibly having calves attain breeding size sooner. Healthy calves are more profitable than sick calves. Impaired reproductive performance is a major cause of reduced productivity for ruminants and decreased profitability for dairy and meat animal producers. Improving fertility in ruminants requires fundamental knowledge about the influence of oocyte quality, follicular development, corpus luteum function, and uterine environment on embryonic survival. Some diseases of the retina in animals and humans result from defects in the enzymes controlling the initial events of vision.

**2. Ultimate goal(s) of this Program**

Improve dairy farm profitability through optimal growth and health while reducing environmental impacts. To improve the efficiency of milk and milk protein production by more precise formulation of dairy cattle diets for protein and thus, promote greater environmental and economic sustainability in the US dairy industry. To decrease embryonic mortality and improve reproductive performance in dairy cows. Provide important new information concerning declining fertility among ruminants in the face of continuous improvement in production capability. To define the biochemical pathway responsible for cone vision, so that defects in vision in animals and humans that result from impaired functioning of cone photoreceptors can be therapeutically treated.

**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
2010	0.0	0.0	2.4	0.0
2011	0.0	0.0	2.4	0.0
2012	0.0	0.0	2.4	0.0
2013	0.0	0.0	2.4	0.0
2014	0.0	0.0	2.4	0.0

**V(F). Planned Program (Activity)****1. Activity for the Program**

Evaluate genetic, morphological and physiological attributes of the ovary considered to improve fertility in ruminants. Characterize genetic and metabolic/nutritional attributes associated with embryo survival in ruminants. Use a combination of cellular, genetic and molecular tools to characterize luteal microvascular endothelial cells obtained from early, mid and late cycle bovine corpora lutea. Comparative genomic analysis, evolutionary trace analysis, and site-directed mutagenesis to identify differences in the structure of rod and cone PDE6 that lead to changes in enzyme activity or regulation. Isolate phototransduction proteins from the retina and determine their relative abundance in rod and cone photoreceptor cells using quantitative immunological techniques.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● Other 1 (Laboratory &amp; Field Research)</li> <li>● Education Class</li> <li>● Demonstrations</li> <li>● Other 2 (Present at scientific meetings)</li> <li>● Workshop</li> </ul>	<ul style="list-style-type: none"> <li>● Web sites</li> <li>● Other 1 (Peer reviewed publications)</li> </ul>

**3. Description of targeted audience**

The target audience includes scientists, graduate and undergraduate students, producers and consumers, animal nutrition, reproduction and health workers, and animal welfare advocates.

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	350	1150	50	25
2011	250	650	50	25
2012	250	550	50	25
2013	250	550	50	25
2014	200	500	50	25

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

**Expected Patent Applications**

2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	7	0	7
2011	7	0	7
2012	6	0	6
2013	6	0	6
2014	6	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- Number of participants in the project (not including audience counts)

<b>2010</b> :15	<b>2011</b> :12	<b>2012</b> :12	<b>2013</b> :12	<b>2014</b> :12
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- Number of undergraduate students directly involved in the projects

<b>2010</b> :5	<b>2011</b> :5	<b>2012</b> :5	<b>2013</b> :5	<b>2014</b> :5
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- Number of graduate student directly involved in the projects

<b>2010</b> :3	<b>2011</b> :3	<b>2012</b> :3	<b>2013</b> :3	<b>2014</b> :3
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- Number of reviewed publications including theses and abstracts)

<b>2010</b> :9	<b>2011</b> :7	<b>2012</b> :7	<b>2013</b> :7	<b>2014</b> :5
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- Number of peer-reviewed publications

<b>2010</b> :3	<b>2011</b> :3	<b>2012</b> :3	<b>2013</b> :3	<b>2014</b> :3
----------------	----------------	----------------	----------------	----------------

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	Number of graduate students involved and trained
2	Number of undergraduate students involved and trained
3	Increased knowledge through publications and other measures
4	Increased knowledge about animal management, nutrition, reproduction, and health

**Outcome #1****1. Outcome Target**

Number of graduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> :4	<b>2011</b> : 4	<b>2012</b> : 4	<b>2013</b> :4	<b>2014</b> :4
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**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 305 - Animal Physiological Processes
- 307 - Animal Production Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 315 - Animal Welfare, Well-Being and Protection

**Outcome #2****1. Outcome Target**

Number of undergraduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> :7	<b>2011</b> : 7	<b>2012</b> : 7	<b>2013</b> : 7	<b>2014</b> :7
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**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes
- 307 - Animal Production Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 315 - Animal Welfare, Well-Being and Protection

**Outcome #3****1. Outcome Target**

Increased knowledge through publications and other measures

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010** 3                      **2011** : 3                      **2012** : 3                      **2013** 3                      **2014** :3

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes
- 307 - Animal Production Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 315 - Animal Welfare, Well-Being and Protection

**Outcome #4**

**1. Outcome Target**

Increased knowledge about animal management, nutrition, reproduction, and health

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010** 0                      **2011** : 0                      **2012** : 0                      **2013** 0                      **2014** :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes
- 307 - Animal Production Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 315 - Animal Welfare, Well-Being and Protection

**V(J). Planned Program (External Factors)**

**1. External Factors which may affect Outcomes**

- Economy
- Natural Disasters (drought,weather extremes,etc.)
- Competing Programmatic Challenges
- Appropriations changes

**Description**

Extreme or anomalous weather conditions or natural disasters can interfere with work, or produce atypical results that require changes in research methodology or direction. Change in the economy can change regional priorities and necessitate refocusing research. The success of the research is highly dependent on continued funding of NHAES at a sufficient level. Budgetary pressures mandate that competing programs be prioritized to maximize relevance and productivity.

## **V(K). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- Time series (multiple points before and after program)
- Before-After (before and after program)
- During (during program)

#### **Description**

Evaluation of work will be based on peer review acceptance of manuscripts and papers, industry acceptance and application of results. Though established networking with the dairy & feed industry, university researchers, dairy and poultry farmers, & nutrition consultants and through presentations at conferences, immediate feedback will be obtained.

### **2. Data Collection Methods**

- Unstructured
- Observation
- Other (see below)
- Sampling

#### **Description**

{NO DATA ENTERED}

**V(A). Planned Program (Summary)**

**Program #3**

**1. Name of the Planned Program**

Biotechnology & Genomics

**2. Brief summary about Planned Program**

A number of the projects that were listed in this program in previous Plans of Work have been moved to other programs such as Sustainable Horticulture and Sustainable Marine Aquaculture and Fisheries. This program includes investigation of Endocrine Control of Reproduction, Regulation of Polyamine Metabolism and Stress Response in Poplar, Mechanisms of Host Adaptive Evolution and Host-range Expansion in the Genus Vibrio, Character and Control of Yeast Regulatory Genes, and the Role of Protein Phosphatase 2A in Auxin Signaling and Root Response to Gravity.

**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
135	Aquatic and Terrestrial Wildlife			10%	
201	Plant Genome, Genetics, and Genetic Mechanisms			20%	
205	Plant Management Systems			10%	
206	Basic Plant Biology			15%	
215	Biological Control of Pests Affecting Plants			20%	
304	Animal Genome			15%	
305	Animal Physiological Processes			10%	
	<b>Total</b>			100%	

**V(C). Planned Program (Situation and Scope)****1. Situation and priorities**

Lampreys are an example of fish species that has created significant environmental problem, especially in the Great Lakes. Gaining a further understanding of GnRH, its analogs, its receptors, interactions with neurotransmitters and microencapsulation will be critical for development of novel strategies for improving and controlling reproduction of problematic fish species such as lampreys. Understanding plant response to abiotic stress is needed for design and development of resistant varieties of plants, including trees. Also, plants could be designed for improved nutritional or agronomic features. Characterizing conserved components involved in mRNA degradation may impact understanding as to how genes and proteins are expressed. A thorough understanding of plant growth and development at a basic level will have long-term impacts on agriculture. Plant tolerance to environmental challenges is of utmost importance for maintaining our food supply in light of impacts from climate change, decreasing availability of irrigation water, and increased demand for food.

**2. Scope of the Program**

- In-State Research

**V(D). Planned Program (Assumptions and Goals)****1. Assumptions made for the Program**

Explanations for plant responses to abiotic stress will be found that will be widely applicable. A thorough understanding of plant growth and development at a basic level will have long-term impacts on agriculture. Plant tolerance to environmental challenges is of utmost importance for maintaining our food supply in light of impacts from climate change, decreasing availability of irrigation water, and increased demand for food. mRNA degradation in yeast is evolutionarily conserved and functionally related to higher eukaryotic mRNA degradation. A detailed understanding of the genetic basis for achieving optimal plant growth will benefit agriculture in the long term. Resources and funding will be available.

**2. Ultimate goal(s) of this Program**

To develop an alternate method by sterilizing male sea lampreys using a lamprey GnRH antagonist. Understand abiotic stress response in plants and production of plant varieties that are tolerant to short term drought, salinity and heavy metals. Identification of the proteins and complexes that specifically contact PAB1. Determining at what stages in mRNA metabolism specific proteins contact PAB1. To understand how intracellular processes in plants affect plant growth and productivity.

**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
2010	0.0	0.0	3.0	0.0
2011	0.0	0.0	3.0	0.0
2012	0.0	0.0	3.0	0.0
2013	0.0	0.0	3.0	0.0
2014	0.0	0.0	3.0	0.0

**V(F). Planned Program (Activity)****1. Activity for the Program**

Perform molecular, biochemical, and physiological research, analyze data & screen genomes. Application of molecular

genetic techniques and biochemical analyses. mRNA deadenylation rates will be determined, mRNA binding studies will be conducted, protein binding analysis will be studied using immunoprecipitations and western analysis. Prepare and submit manuscripts to to peer-reviewed journals. Train undergraduate and graduate students.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● Other 2 (Present at Scientific Meetings)</li> <li>● Other 1 (Laboratory Research)</li> </ul>	<ul style="list-style-type: none"> <li>● Web sites</li> <li>● Other 1 (Peer reviewed publications)</li> <li>● TV Media Programs</li> </ul>

**3. Description of targeted audience**

The target audience includes scientists, graduate and undergraduate students, and those working to improve genetic and genomic resources.

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons(contacts) to be reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	600	150	25	50
2011	500	600	25	50
2012	500	600	25	50
2013	500	600	25	50
2014	500	500	25	50

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

**Expected Patent Applications**

2010 :1                      2011 :0                      2012 :1                      2013 :1                      2014 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	9	0	9
2011	5	0	5
2012	7	0	7
2013	6	0	6
2014	6	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- Number of participants in the project (not including audience counts)

<b>2010</b> :12	<b>2011</b> :12	<b>2012</b> :12	<b>2013</b> :12	<b>2014</b> :12
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- Number of undergraduate students directly involved in the projects

<b>2010</b> :3	<b>2011</b> :3	<b>2012</b> :3	<b>2013</b> :3	<b>2014</b> :4
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- Number of graduate student directly involved in the projects

<b>2010</b> :4	<b>2011</b> :4	<b>2012</b> :4	<b>2013</b> :4	<b>2014</b> :4
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- Number of non-peer-reviewed publications including theses, abstracts, etc

<b>2010</b> :9	<b>2011</b> :9	<b>2012</b> :9	<b>2013</b> :9	<b>2014</b> :9
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- Number of peer-reviewed publications

<b>2010</b> :3	<b>2011</b> :3	<b>2012</b> :3	<b>2013</b> :3	<b>2014</b> :3
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**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	Number of graduate students involved and trained
2	Number of undergraduate students involved and trained
3	Increased knowledge through publications and other means

**Outcome #1****1. Outcome Target**

Number of graduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> 6	<b>2011</b> : 6	<b>2012</b> : 6	<b>2013</b> 6	<b>2014</b> :6
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**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 215 - Biological Control of Pests Affecting Plants
- 304 - Animal Genome
- 305 - Animal Physiological Processes

**Outcome #2****1. Outcome Target**

Number of undergraduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> 4	<b>2011</b> : 4	<b>2012</b> : 4	<b>2013</b> 4	<b>2014</b> :4
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**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 215 - Biological Control of Pests Affecting Plants
- 304 - Animal Genome
- 305 - Animal Physiological Processes

**Outcome #3****1. Outcome Target**

Increased knowledge through publications and other means

**2. Outcome Type :** Change in Knowledge Outcome Measure

<b>2010</b> 0	<b>2011</b> : 0	<b>2012</b> : 0	<b>2013</b> 0	<b>2014</b> :0
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**3. Associated Institute Type(s)**

•1862 Research

#### 4. Associated Knowledge Area(s)

- 135 - Aquatic and Terrestrial Wildlife
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 215 - Biological Control of Pests Affecting Plants
- 304 - Animal Genome
- 305 - Animal Physiological Processes

#### V(J). Planned Program (External Factors)

##### 1. External Factors which may affect Outcomes

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

##### Description

Extreme or anomalous weather conditions or natural disasters can interfere with work, or produce atypical results that require changes in research methodology or direction. Change in the economy can change regional priorities and necessitate refocusing research. The success of the research is highly dependent on continued funding of NHAES at a sufficient level. Budgetary pressures mandate that competing programs be prioritized to maximize relevance and productivity.

#### V(K). Planned Program (Evaluation Studies and Data Collection)

##### 1. Evaluation Studies Planned

- After Only (post program)
- During (during program)
- Before-After (before and after program)
- Time series (multiple points before and after program)

##### Description

Evaluation of work will be based on peer review acceptance of manuscripts and papers, industry acceptance and application of results, and through presentations at conferences, immediate feedback will be obtained.

##### 2. Data Collection Methods

- Unstructured
- Other (Q & A sessions)
- Sampling

##### Description

Feedback from target audiences (other scientists, students, etc) will be collected through questions and comments at meetings, proposal and manuscript reviews, and website stakeholder input tools.

**V(A). Planned Program (Summary)**

**Program #4**

**1. Name of the Planned Program**

Communities, Economics & Commerce

**2. Brief summary about Planned Program**

The NHAES currently has five projects related to Economics and Commerce, and this number will change during the five year term. The current projects include: Interactions of individual, family, community and policy contexts on the mental and physical health of diverse rural low-income families; economic considerations in municipal solid waste disposal; benefits and costs of natural resources policies affecting public and private lands; rural change related to markets, governance and quality of life; and population dynamics and change related to aging, ethnicity and land use change in rural communities.

**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			3%	
131	Alternative Uses of Land			2%	
403	Waste Disposal, Recycling, and Reuse			5%	
604	Marketing and Distribution Practices			6%	
605	Natural Resource and Environmental Economics			10%	
608	Community Resource Planning and Development			15%	
609	Economic Theory and Methods			9%	
610	Domestic Policy Analysis			7%	
704	Nutrition and Hunger in the Population			9%	
801	Individual and Family Resource Management			7%	
802	Human Development and Family Well-Being			10%	
803	Sociological and Technological Change Affecting Individuals, Families and Communities			7%	
805	Community Institutions, Health, and Social Services			4%	
903	Communication, Education, and Information Delivery			6%	
	<b>Total</b>			100%	

**V(C). Planned Program (Situation and Scope)****1. Situation and priorities**

Rural low income families have issues not faced (or to a lesser extent) by urban low income families. We will be identifying these issues in order to inform the future waves of inquiry. Waste management/disposal costs have more than tripled in the past two decades. State and local governments need economic analysis of various management options. Land use and land use change have major impacts on the flows and values of ecosystem services. New legislation on green energy has been passed, and there are new goals set for "green" energy production. As oil prices increase, the demand for alternative technologies will grow, so an assessment of current demand is useful for both government bodies and technology developers. New sources of employment in rural America that don't require relocation per se, can serve an important component in the arena of rural development and improving the lives of rural residents. Information on population dynamics and change in rural communities is needed for state planners and policy-makers to facilitate actions to enhance the social and economic development of the state, aid in developing comprehensive plans to guide future landscape development, and protect the state's abundant natural resources.

**2. Scope of the Program**

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

**V(D). Planned Program (Assumptions and Goals)****1. Assumptions made for the Program**

Rural low income families will continue to have health issues that will influence their ability to maintain employment to provide financial security for their families. State and local governments need economic analysis of various management options concerning waste management/disposal. Land use and land use change have major impacts on the flows and values of ecosystem services. Funding will remain constant or increase. We require a better understanding of consumer demand for sustainable, green, and energy efficient technology to be used for consumer education, research and development, and legislation. Firms will respond to customer dissatisfaction with many off-shored activities by moving those activities back home and to rural America. Demographic change will continue in both urban and rural areas. The population is likely to become increasingly diverse in the future. The demographic shifts occasioned by the aging of the baby-boom is likely to have significant implications for landscape change in rural areas of New England and the Northeast. A more complete understanding of such demographic processes will facilitate better planning for the future.

**2. Ultimate goal(s) of this Program**

To examine individual and family level characteristics which impact physical and mental health in diverse rural low-income families, to examine policies that impact family mental and physical health in diverse rural low-income families, and to examine the interface of health and financial security now and in the future for individuals and families. To continue to provide local, state, and regional governments with up to date information on making informed waste management decisions. Develop a better understanding of consumer driven demand for energy efficient technology, so that education, legislation, development, and delivery of this technology can be optimized. Improve the livelihoods of rural residents and improve customer satisfaction with firms and in turn to enhance the viability of firms. To more fully understand the dynamics of demographic change, aging and ethnic and land use change in the rural areas of New Hampshire and compare them to demographic processes and trends in other areas of nonmetropolitan America. To use such findings to facilitate better planning for the economic, social and environmental changes likely to impact the rural areas of the state, region and nation in future years.

**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
2010	0.0	0.0	1.3	0.0
2011	0.0	0.0	1.3	0.0
2012	0.0	0.0	1.3	0.0
2013	0.0	0.0	1.3	0.0
2014	0.0	0.0	1.0	0.0

**V(F). Planned Program (Activity)**

**1. Activity for the Program**

Structured interviews will be conducted with community participants. A small number of families will be selected for qualitative semi-structured interviews. Interview protocols will be approved by the UNH-IRB prior to any interviews taking place. Formal and informal observation will be conducted to determine how research results are being used, such as specific changes in practice or policy; continued econometric analysis of unit based trash disposal; relationship between social capital and land use change. Consumer survey will evaluate willingness to pay to adopt technology such as solar hot water heaters. Cross-sectional regression analysis will be undertaken. Model estimates will be compared to actual longitudinal data trends as new Census data are released.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● Workshop</li> <li>● Education Class</li> <li>● Group Discussion</li> <li>● Demonstrations</li> <li>● Other 1 (scientific meetings)</li> <li>● One-on-One Intervention</li> <li>● Other 2 (networking meetings)</li> </ul>	<ul style="list-style-type: none"> <li>● Web sites</li> <li>● Newsletters</li> <li>● Other 1 (peer reviewed publications)</li> </ul>

**3. Description of targeted audience**

State, local, and regional waste management professionals, scientists, undergraduate and graduate students, citizens, land use professionals, homeowners, sustainable energy associations, legislators, contractors, firms and rural residents, demographers, social and natural scientists as well as policy-makers and the media.

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons(contacts) to be reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	3000	2000000	1000	3000
2011	3000	2000000	1000	3000
2012	3000	2000000	1000	3000
2013	3000	2000000	1000	3000
2014	3000	75000	1000	3000

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

**Expected Patent Applications**

**2010 :1                      2011 :1                      2012 :1                      2013 :0                      2014 :0**

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	6	0	6
2011	6	0	6
2012	6	0	6
2013	6	0	6
2014	4	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- Number of undergraduate students directly involved in the projects

**2010 6                      2011 6                      2012 :6                      2013 6                      2014 6**

- Number of graduate student directly involved in the projects

**2010 5                      2011 5                      2012 :5                      2013 5                      2014 4**

- Number of workshops and training sessions

**2010 6                      2011 6                      2012 :6                      2013 :10                      2014 6**

- Number of non-peer-reviewed publications (theses, abstracts, newsletters, fact sheets, articles, etc)

**2010 :15                      2011 :15                      2012 :15                      2013 :15                      2014 :10**

- Number of peer-reviewed publications

**2010 2                      2011 2                      2012 :2                      2013 2                      2014 2**

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	Number of graduate students involved and trained
2	Number of undergraduate students involved and trained
3	Increased knowledge through publications and other means

**Outcome #1**

**1. Outcome Target**

Number of graduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

**2010** 2                      **2011** : 2                      **2012** : 2                      **2013** 2                      **2014** : 3

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 111 - Conservation and Efficient Use of Water
- 131 - Alternative Uses of Land
- 403 - Waste Disposal, Recycling, and Reuse
- 604 - Marketing and Distribution Practices
- 605 - Natural Resource and Environmental Economics
- 608 - Community Resource Planning and Development
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 704 - Nutrition and Hunger in the Population
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 803 - Sociological and Technological Change Affecting Individuals, Families and Communities
- 805 - Community Institutions, Health, and Social Services

**Outcome #2**

**1. Outcome Target**

Number of undergraduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

**2010** 8                      **2011** : 8                      **2012** : 8                      **2013** 8                      **2014** : 8

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 111 - Conservation and Efficient Use of Water
- 131 - Alternative Uses of Land
- 403 - Waste Disposal, Recycling, and Reuse
- 604 - Marketing and Distribution Practices
- 605 - Natural Resource and Environmental Economics
- 608 - Community Resource Planning and Development
- 609 - Economic Theory and Methods

- 610 - Domestic Policy Analysis
- 704 - Nutrition and Hunger in the Population
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 803 - Sociological and Technological Change Affecting Individuals, Families and Communities
- 805 - Community Institutions, Health, and Social Services
- 903 - Communication, Education, and Information Delivery

**Outcome #3**

**1. Outcome Target**

Increased knowledge through publications and other means

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 0	2011 : 0	2012 : 0	2013 0	2014 : 0
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**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 111 - Conservation and Efficient Use of Water
- 131 - Alternative Uses of Land
- 403 - Waste Disposal, Recycling, and Reuse
- 604 - Marketing and Distribution Practices
- 605 - Natural Resource and Environmental Economics
- 608 - Community Resource Planning and Development
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 704 - Nutrition and Hunger in the Population
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 803 - Sociological and Technological Change Affecting Individuals, Families and Communities
- 805 - Community Institutions, Health, and Social Services
- 903 - Communication, Education, and Information Delivery

**V(J). Planned Program (External Factors)**

**1. External Factors which may affect Outcomes**

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

#### **Description**

For any field research in agriculture or natural resources, extreme and/or anomalous weather conditions or natural disasters can create new issues that require changes in planned research focus or methodology. Change in the economy can change regional priorities and necessitate refocusing research. The success of the research is dependent on continued NHAES funding at a sufficient level. Changes in public policy, government regulations, competing public or NHAES might result in a rebalancing of competing programmatic investment and/or a change in program direction.

### **V(K). Planned Program (Evaluation Studies and Data Collection)**

#### **1. Evaluation Studies Planned**

- During (during program)
- Time series (multiple points before and after program)
- Before-After (before and after program)

#### **Description**

Evaluation of work will be based on peer review acceptance of manuscripts and papers, industry acceptance and application of results.

Project 1. Quantitative and qualitative assessment of impact of interventions to strengthen local food economies through participation by farmers, food enterprises and schools and institutions. Assessment of products produced including website, newsletters and meetings for New Hampshire Center for a Food Secure Future

Project 2. This research will use comparative research that is by its very nature evaluation orientated. It will use time series data to evaluate the effectiveness and application of the web-based engagement tools. Experimental research designs will be utilized as well as triangulation through mixed method research designs. The research will compare outcomes across watersheds, states, and regions. This project will track outcomes and application of the tools and research protocols.

Project 3. Consumer survey will evaluate willingness to pay to adopt technology, such as solar hot water heaters.

Project 4. Formal and informal observation to determine how research results are being used e.g. specific changes in practice or policy. Continued analysis of data on local recycling gathered in previous years

#### **2. Data Collection Methods**

- Case Study
- Whole population
- Unstructured
- On-Site
- Other (web based surveys)
- Sampling
- Observation

#### **Description**

Feedback from target audiences (other scientists, students, regulatory agencies, planners, etc) will be collected through questions and comments at meetings, proposal and manuscript reviews, and website stakeholder input tools.

Project 1. Case studies of Farm-To-School examples are developed on an ongoing basis for education and communication; participants will be interviewed to assess progress, needs and impacts.

Project 3. Focus groups, pre-testing of a survey, mail and internet survey.

Project 4. Face to face and telephone surveys of targeted populations.

Project 5. Three waves of data were collected between 2000 and 2002 from participating rural low income families using a structured interview. Current data collection is a survey at time of tax preparation (EITC).

Project 6. After testing the results of more expensive mail surveys to a similar internet survey, internet survey techniques will be used.

**V(A). Planned Program (Summary)**

**Program #5**

**1. Name of the Planned Program**

Food, Nutrition & Health

**2. Brief summary about Planned Program**

As we organize our agricultural programs to better undertake strategic initiatives, the number and categories of programs will change through time. We currently have five projects in this program, including: Regulation of Zinc Transport by Endothelial Cells, Improving Plant Food (Fruit, Vegetable and Whole Grain) Availability and Intake in Older Adults, Effect of Insulin Resistance on Th1/Th2 Cytokines, TNF-alpha and Pulmonary Function in Miniature Swine, Environmental Pollutants and Obesity, and Effects of Environmental Conditions on Detection and Populations of Pathogenic Vibrios in Oysters Grown in the Northeast US.

**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
304	Animal Genome			5%	
305	Animal Physiological Processes			4%	
311	Animal Diseases			3%	
502	New and Improved Food Products			2%	
607	Consumer Economics			2%	
701	Nutrient Composition of Food			6%	
702	Requirements and Function of Nutrients and Other Food Components			14%	
703	Nutrition Education and Behavior			18%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			5%	
722	Zoonotic Diseases and Parasites Affecting Humans			4%	
723	Hazards to Human Health and Safety			13%	
724	Healthy Lifestyle			24%	
	<b>Total</b>			100%	

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

#### 1. Situation and priorities

Zinc imbalance in the brain is suspected as a contributor to neurological disorders. This may result when healthy physiological processes that regulate the amount of zinc entering the brain malfunction or are unable to accommodate extremes of zinc malnutrition. We do not currently know how these regulatory processes work in the brain. Despite the USDA recommendations and guidelines, older adults are not physically active not do they consume adequate intake of fruit vegetable and whole grains. Incidence of asthma in New Hampshire is 14%, a percentage that is highest in the New England area and

above the National average. PBDEs are ubiquitous and persistent in our environment. They may disrupt hormone signals once inside the body. The threat of vibrio infections has been a growing concern for the last few decades in the warmer water areas of the US, and more recently it has emerged as a concern in northern areas, including the Northeast US. Previous studies have suggested that these bacteria can be eliminated from shellfish tissue under favorable conditions. It would be a major contribution to the shellfish industry if we can identify and verify the conditions under which live oysters can be processed to become vibrio-free.

**2. Scope of the Program**

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

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

**1. Assumptions made for the Program**

Phytonutrients in fruit vegetables and whole grains will improve health outcomes when consumed in adequate amount. Findings of proposed work will help delineate the mechanism by which obesity may contribute to pulmonary disease. PBDEs are present in the environment. The pig's brain metabolizes zinc similar to the human brain. The pig's brain cells grown in our laboratory respond similarly to how they would respond in the head. Conditions exist where vibrios indigenous to shellfish tissue can be induced to be eliminated from the animals. The non-culture based detection method will provide sensitive and reproducible results for vibrio concentrations in shellfish tissue.

**2. Ultimate goal(s) of this Program**

To develop effective intervention strategies to increase intake of fruit vegetables and whole grains. Identify the mechanism and process by which weight gain in humans promotes pulmonary disease, such as allergic asthma. To evaluate PBDEs as obesogens. To develop treatments for persons who are at risk of Alzheimer's Disease because their ability to regulate zinc in the brain is compromised. To enable the shellfish consumer to be able to consume processed, live shellfish without the fear of infections from pathogenic vibrio bacteria.

**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
2010	0.0	0.0	3.4	0.0
2011	0.0	0.0	3.4	0.0
2012	0.0	0.0	3.4	0.0
2013	0.0	0.0	3.4	0.0
2014	0.0	0.0	0.0	0.0

**V(F). Planned Program (Activity)**

**1. Activity for the Program**

Initial studies will test our hypothesis in vitro using transformed cell line of porcine bronchoalveolar macrophages. Macrophages will be exposed to varying concentrations of insulin and cytokine phenotypes associated with immune response consistent with allergy development. Subsequent experiments will involve feeding cells exposed to insulin, different dietary fatty

acids that are known to influence immune function toward allergy development. Once the experimental question has been answered in vitro, it will be tested in vivo, examining changes in pulmonary function using miniature swine. MP changes as a result of intervention (diet and exercise) will be measured by HFP. Blood samples from pregnant mothers and their infants will be evaluated for exposure to PBDEs and disrupted hormone balance. We will run a variety of pre-application studies with the newly developed detection assay to determine its sensitivity and accuracy and reproducibility. We will then run studies to determine how well we can eliminate vibrios from shellfish under controlled, post-harvest process conditions.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● Other 1 (Laboratory and field research)</li> <li>● Other 2 (One on one discussions)</li> <li>● Education Class</li> <li>● Demonstrations</li> <li>● Workshop</li> <li>● Group Discussion</li> <li>● One-on-One Intervention</li> </ul>	<ul style="list-style-type: none"> <li>● Other 1 (Peer reviewed publications)</li> <li>● Web sites</li> <li>● Newsletters</li> </ul>

**3. Description of targeted audience**

Older adults in NE with a focus to include minority groups and low income populations, scientists, students and others interested in obesity, environmental chemicals, resource/environmental/public health managers, commercial shellfish industry.

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons(contacts) to be reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	600	4300	120	0
2011	350	3800	120	0
2012	150	1300	20	0
2013	150	1300	20	0
2014	150	1200	20	0

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

**Expected Patent Applications**

2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	6	0	6
2011	8	0	8
2012	6	0	6
2013	5	0	5
2014	5	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- Number of undergraduate students directly involved in the projects

2010 6                      2011 6                      2012 6                      2013 6                      2014 6

- Number of graduate student directly involved in the projects

2010 6                      2011 6                      2012 6                      2013 6                      2014 5

- Number of presentation at regional, national, or international scientific meetings

2010 9                      2011 9                      2012 9                      2013 9                      2014 0

- Number of non-peer-reviewed publications (theses, abstracts, newsletters, fact sheets, articles, etc)

2010 10                      2011 10                      2012 8                      2013 8                      2014 6

- Number of peer-reviewed publications

2010 2                      2011 2                      2012 2                      2013 2                      2014 2

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	Number of graduate students involved and trained
2	Number of undergraduate students involved and trained
3	Increased knowledge through publications and other means

**Outcome #1**

**1. Outcome Target**

Number of graduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

**2010 :** 6                      **2011 :** 6                      **2012 :** 6                      **2013 :** 6                      **2014 :** 6

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 304 - Animal Genome
- 305 - Animal Physiological Processes
- 311 - Animal Diseases
- 502 - New and Improved Food Products
- 607 - Consumer Economics
- 701 - Nutrient Composition of Food
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 723 - Hazards to Human Health and Safety
- 724 - Healthy Lifestyle

**Outcome #2**

**1. Outcome Target**

Number of undergraduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

**2010 :** 5                      **2011 :** 5                      **2012 :** 5                      **2013 :** 5                      **2014 :** 5

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 304 - Animal Genome
- 305 - Animal Physiological Processes
- 311 - Animal Diseases
- 502 - New and Improved Food Products
- 607 - Consumer Economics
- 701 - Nutrient Composition of Food
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 723 - Hazards to Human Health and Safety
- 724 - Healthy Lifestyle

**Outcome #3**

**1. Outcome Target**

Increased knowledge through publications and other means

**2. Outcome Type :** Change in Knowledge Outcome Measure

**2010 :** 0                      **2011 :** 0                      **2012 :** 0                      **2013 :** 0                      **2014 :** 0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 304 - Animal Genome
- 305 - Animal Physiological Processes
- 311 - Animal Diseases
- 502 - New and Improved Food Products
- 607 - Consumer Economics
- 701 - Nutrient Composition of Food
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 723 - Hazards to Human Health and Safety
- 724 - Healthy Lifestyle

**V(J). Planned Program (External Factors)**

**1. External Factors which may affect Outcomes**

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

**Description**

For any field research in agriculture, extreme or anomalous weather conditions or natural disasters can interfere with work, or produce atypical results that require changes in research methodology or direction. Change in the economy can change regional priorities and necessitate refocusing research. The success of the research is highly dependent on continued funding of NHAES at a sufficient level. Budgetary pressures mandate that competing programs be prioritized to maximize relevance and

productivity.

## **V(K). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- Time series (multiple points before and after program)
- Before-After (before and after program)
- During (during program)

#### **Description**

Evaluation of work will be based on peer review acceptance of manuscripts and papers, industry acceptance and application of results. . During each project, data are analyzed and research is evaluated.

### **2. Data Collection Methods**

- Unstructured
- Sampling
- Other (Lab and Field Research)
- On-Site
- Observation
- Mail
- Case Study
- Tests

#### **Description**

Feedback from target audiences (other scientists, students, regulatory agencies, planners, etc) will be collected through questions and comments at meetings, proposal and manuscript reviews, and website stakeholder input tools.

**V(A). Planned Program (Summary)**

**Program #6**

**1. Name of the Planned Program**

Natural Resources & Environment

**2. Brief summary about Planned Program**

As we organize our agricultural programs to better undertake strategic initiatives, the number and categories of programs will change through time. We currently have seven projects in this program, including: Land Management and the Invasion of Natural Communities by Exotic Shrubs: An Historical Approach, Linking the Effects of Historic and Contemporary Land Uses to Exotic Shrub Invasions, Effects of Forest Management on Stream Insects in White Mountain National Forest, Ecosystem Services in a Fragmenting Forested Landscape, Cataloguing Marine Invertebrates with Molecular Barcodes, Tracking the Dispersal of Invasive Algal Species With Molecular Techniques, and Microcystins in Lakes: Localized Impacts of Blooms and Implications for Human Health.

**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			20%	
112	Watershed Protection and Management			5%	
123	Management and Sustainability of Forest Resources			8%	
132	Weather and Climate			2%	
133	Pollution Prevention and Mitigation			2%	
134	Outdoor Recreation			2%	
135	Aquatic and Terrestrial Wildlife			31%	
136	Conservation of Biological Diversity			15%	
213	Weeds Affecting Plants			2%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals			8%	
315	Animal Welfare, Well-Being and Protection			2%	
605	Natural Resource and Environmental Economics			2%	
903	Communication, Education, and Information Delivery			1%	
	<b>Total</b>			100%	

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

#### 1. Situation and priorities

Invasive, non-native shrubs have been shown to reduce regeneration of economically important forest trees. They also harbor higher populations of black-legged ticks (carriers of Lyme disease) than other types of forest understory. Such shrubs are

increasing in abundance in natural and managed forests throughout the eastern USA. Invasive shrubs threaten to disrupt forest regeneration and alter terrestrial communities. While insects are often used as tools for indicating change, the between-year variation in biodiversity and abundance is unexplored. To understand changes due to management or climatic change, the baseline between-year variation must be documented. Characterizing human impacts on ecosystem services encompasses several of the Grand Challenges in Environmental Sciences (NRC 2001). In New Hampshire, as in much of New England, forests provide some of the most important ecosystem services, including clean water, fuel, fiber, essential habitat, carbon sequestration, and vital economic opportunities for tourism and recreation. We currently lack a baseline of the invertebrate biodiversity of the Gulf of Maine, which would aid in the future recognition of alien or invasive species by detecting shifts in invertebrate communities. Over the last 20 years two introduced marine algae have become serious threats to coastal habitats in the Gulf of Maine. They are threatening juvenile fish habitats, disrupting shellfish beds, and fouling beaches. Blue green bacteria blooms and their associated toxic releases are already impacting NH by causing beach closures and surface water supply concerns. Research is needed to better understand why these blooms are occurring more often, what triggers these blooms and toxin releases as well as what management practices can be employed to predict, prevent and /or manage for these occurrences. In addition, less attention has been focused on the fate of these toxins as they move through the aquatic/terrestrial food web. Current speculation has these blooms impacting loon health and loons are a very charismatic species in this state.

## 2. Scope of the Program

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

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

### 1. Assumptions made for the Program

Interest in, concern about, and commitment to control of invasive plants will increase over time. Non-native shrubs can be controlled. Identity of areas vulnerable to invasive shrubs will be based on few factors. Biodiversity and abundances will vary insignificantly between-years, and allow establishment of a stable set of diversity/abundance values that will be typical of White Mountain National Forest streams. Fragmentation is assumed to affect ecosystem services as it affects the species assemblages of plants, animals, and microbes. It is unlikely that invasive algae will be contained, but better understanding of the interactions of invasive species may provide information to contain or control introduction of additional species in the future. Demand on lakes by recreation and drinking water continues to increase. Funding and graduate student interest will continue to be high. Water supply managers will continue to be interested in this phenomenon. Bloom dynamics can be defined by water conditions. Funding will remain constant or increase.

### 2. Ultimate goal(s) of this Program

To promote silvicultural methods that minimize the invasion of non-native shrubs and thus their impact on forest productivity and biological diversity. Develop management protocols that limit spread of invasive shrubs. To document stream diversity and abundances for typical national forest streams that will identify a core groups of species that will serve as a baseline for measuring the effects of forest disturbance events, either through forest management or climate change. Although our initial efforts will produce valuable short-term products, our research initiative will also include development of a long-term research infrastructure that will document the trajectory of change in our study region and provide insights into the tradeoffs in ecosystem services that accompany various development strategies. To assess invertebrate biodiversity of the Gulf of Maine. To provide a web page of biodiversity information of marine invertebrates including genetic, species, and habitat data. To determine the population structure of introduced algal species, to determine whether their invasive behavior results of adaptation to the new environment or from repeated introductions of more aggressive genotypes of the marine macroalgae. To predict the occurrence of blue green bacteria blooms to assist lake and water supply managers. To trace the horizontal distribution of cyanobacteria within lakes and the movement of microcystin toxin through the food web to better understand the long-term impacts of these blooms on recreational and charismatic species. To reduce and prevent the occurrence of blue green bacteria blooms through informed watershed management.

## 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
2010	0.0	0.0	5.8	0.0
2011	0.0	0.0	5.8	0.0
2012	0.0	0.0	5.8	0.0
2013	0.0	0.0	5.8	0.0
2014	0.0	0.0	6.0	0.0

**V(F). Planned Program (Activity)**

**1. Activity for the Program**

Invasive shrubs will be examined using wood ring analyses under silvicultural treatments that include clear-cutting, group selection, selective cutting, and no-treatment. Diversity and abundance of 350 aquatic insect species will be monitored before and after forest management disturbances. Vegetation, soil, and wildlife (amphibians) will be monitored at multiple points over the study period in unfragmented and fragmenting landscapes. Wildlife responses to invasive shrubs along a continuum of shrub abundance will be evaluated. Changes in invertebrate communities will be evaluated using genetic methods. New invasive species will be detected and their spread and points of origin determined. The genetic structure of local populations will be determined and compared to potential source populations in other geographies. Biotoxins and cyanobacteria in waters, and biotoxins in food web components will be monitored pre- and post outreach. Assessment of awareness of biotoxins as a lake water quality issue will be evaluated pre- and post program.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● Workshop</li> <li>● Group Discussion</li> <li>● One-on-One Intervention</li> <li>● Demonstrations</li> <li>● Other 1 (Field and laboratory research)</li> <li>● Education Class</li> </ul>	<ul style="list-style-type: none"> <li>● Web sites</li> <li>● Other 1 (Peer reviewed publications)</li> <li>● Newsletters</li> </ul>

**3. Description of targeted audience**

Forest landowners, foresters and forest ecologists, loggers, conservation groups, land protection groups,(land trusts, etc.), ecologists, silviculturalists, state, contract, local, regional, and national individuals or groups that utilize aquatic insects as indicators of water quality, and those interested in the effects of disturbance upon these group, conservation biologists, resource managers, aquaculture farmers, fisheries biologists, and biosecurity officers including customs officials, specialists for invasive species control, state agencies, lakes associations, lakes congress, water suppliers, secondary schools, interested members of the public.

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons(contacts) to be reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	900	1500	50	80
2011	900	1500	50	80
2012	900	1500	50	80
2013	900	1500	50	80
2014	800	1500	50	100

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

**Expected Patent Applications**

2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	12	0	12
2011	12	0	12
2012	12	0	12
2013	12	0	12
2014	12	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- Number of undergraduate students directly involved in the projects  
 2010 :15                      2011 :10                      2012 :10                      2013 :10                      2014 :10
- Number of graduate students directly involved in the projects  
 2010 :15                      2011 :10                      2012 :10                      2013 :10                      2014 :8
- Number of non-peer-reviewed publications (theses, abstracts, newsletters, fact sheets, articles, etc)  
 2010 :18                      2011 :12                      2012 :12                      2013 :12                      2014 :8
- Number of websites in which project results have been incorporated  
 2010 :12                      2011 :12                      2012 :12                      2013 :12                      2014 :4
- Number of peer-reviewed publications  
 2010 :4                      2011 :4                      2012 :4                      2013 :4                      2014 :4

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	Number of graduate students involved and trained
2	Number of undergraduate students involved and trained
3	Increased knowledge through publications and other means

**Outcome #1****1. Outcome Target**

Number of graduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> 6	<b>2011</b> : 6	<b>2012</b> : 6	<b>2013</b> 6	<b>2014</b> :6
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**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 112 - Watershed Protection and Management
- 123 - Management and Sustainability of Forest Resources
- 132 - Weather and Climate
- 133 - Pollution Prevention and Mitigation
- 134 - Outdoor Recreation
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 213 - Weeds Affecting Plants
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
- 315 - Animal Welfare, Well-Being and Protection
- 605 - Natural Resource and Environmental Economics
- 903 - Communication, Education, and Information Delivery

**Outcome #2****1. Outcome Target**

Number of undergraduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> 6	<b>2011</b> : 6	<b>2012</b> : 6	<b>2013</b> 6	<b>2014</b> :6
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**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 112 - Watershed Protection and Management
- 123 - Management and Sustainability of Forest Resources
- 132 - Weather and Climate
- 133 - Pollution Prevention and Mitigation
- 134 - Outdoor Recreation
- 135 - Aquatic and Terrestrial Wildlife

- 136 - Conservation of Biological Diversity
- 213 - Weeds Affecting Plants
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
- 315 - Animal Welfare, Well-Being and Protection
- 605 - Natural Resource and Environmental Economics
- 903 - Communication, Education, and Information Delivery

**Outcome #3**

**1. Outcome Target**

Increased knowledge through publications and other means

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 0	2011 :0	2012 :0	2013 0	2014 :0
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**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 112 - Watershed Protection and Management
- 123 - Management and Sustainability of Forest Resources
- 132 - Weather and Climate
- 133 - Pollution Prevention and Mitigation
- 134 - Outdoor Recreation
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 213 - Weeds Affecting Plants
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
- 315 - Animal Welfare, Well-Being and Protection
- 605 - Natural Resource and Environmental Economics
- 903 - Communication, Education, and Information Delivery

**V(J). Planned Program (External Factors)**

**1. External Factors which may affect Outcomes**

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

## Description

For any field research in agriculture, extreme or anomalous weather conditions or natural disasters can interfere with work, or produce atypical results that require changes in research methodology or direction. Change in the economy can change regional priorities and necessitate refocusing research. The success of the research is highly dependent on continued funding of NHAES at a sufficient level. Budgetary pressures mandate that competing programs be prioritized to maximize relevance and productivity.

## V(K). Planned Program (Evaluation Studies and Data Collection)

### 1. Evaluation Studies Planned

- During (during program)
- Retrospective (post program)
- After Only (post program)
- Time series (multiple points before and after program)
- Case Study
- Before-After (before and after program)

## Description

Evaluation of work will be based on peer review acceptance of manuscripts and papers, industry acceptance and application of results. During each project, data are analyzed and research is evaluated.

### 2. Data Collection Methods

- Sampling
- Case Study
- Other (Reviews)
- Unstructured
- Journals
- On-Site
- Observation

## Description

Feedback from target audiences (other scientists, students, regulatory agencies, planners, etc) will be collected through questions and comments at meetings, proposal and manuscript reviews, and website stakeholder input tools.

**V(A). Planned Program (Summary)**

**Program #7**

**1. Name of the Planned Program**

Pest Management

**2. Brief summary about Planned Program**

As we organize our agricultural programs to better undertake strategic initiatives, the number and categories of programs will change through time. We currently have a single project in this program: Hormonal Control of Reproduction and Parental Care in Burying Beetles. In the future we may increase the number of programs in this program, or move them into related programs.

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

**4. Program duration :** Short-Term (One year or less)

**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
215	Biological Control of Pests Affecting Plants			100%	
	<b>Total</b>			100%	

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

**1. Situation and priorities**

Little is known about the hormonal control of reproduction by beetles, many of which are pests. Better understanding of the endocrine processes will lead to better and safer methods of pest control.

**2. Scope of the Program**

- Multistate Research
- In-State Research

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

**1. Assumptions made for the Program**

Juvenile hormone plays an important role in regulating reproductive physiology or behavior, or both.

**2. Ultimate goal(s) of this Program**

To understand the physiological control of the complex reproductive behavior, which includes elaborate parental care of burying beetles.

**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
2010	0.0	0.0	0.5	0.0
2011	0.0	0.0	0.0	0.0
2012	0.0	0.0	0.0	0.0
2013	0.0	0.0	0.0	0.0
2014	0.0	0.0	0.0	0.0

**V(F). Planned Program (Activity)****1. Activity for the Program**

Evaluate how hormones control reproductive physiology and behavior of beetles that are opportunistic breeders. Use multiple species of burying beetles as a model system, as this group displays a variety of life histories. Treatments will be compared using common statistical tests. Manuscripts will be submitted to peer reviewed journals. Presentations will be given at regional, national and/or international meetings. Grant proposals will be submitted. There will be training of undergraduate students, graduate students and/or postdoctoral fellows. Beetles of several species will be trapped locally. Hemolymph will be taken at designated times and during a reproductive bout and will be analyzed using radioimmunoassay for juvenile hormone titers.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● Other 2 (Laboratory research)</li> <li>● Other 1 (Field Research)</li> </ul>	<ul style="list-style-type: none"> <li>● Other 1 (Peer reviewed publications)</li> </ul>

**3. Description of targeted audience**

Target audience will include students in university classrooms, and scientists in behavioral ecology or behavioral endocrinology and agricultural pest research.

**V(G). Planned Program (Outputs)****1. Standard output measures**

**Target for the number of persons(contacts) to be reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

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

**Expected Patent Applications**

**2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0**

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	1	0	1
2011	1	0	0
2012	1	0	0
2013	1	0	0
2014	1	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- Number of undergraduate students directly involved in the projects

**2010 :1                      2011 :1                      2012 :1                      2013 :1                      2014 :1**

- Number of graduate student directly involved in the projects

**2010 :1                      2011 :1                      2012 :1                      2013 :1                      2014 :1**

- Number of non-peer-reviewed publications (theses, abstracts, newsletters, fact sheets, articles, etc)

**2010 :1                      2011 :1                      2012 :0                      2013 :1                      2014 :0**

- Number of websites in which project results have been incorporated

**2010 :1                      2011 :1                      2012 :1                      2013 :1                      2014 :1**

- Number of peer-reviewed publications

**2010 :1                      2011 :0                      2012 :1                      2013 :1                      2014 :1**

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	Increase in knowledge about hormonal control of reproduction and parental care in beetles (qualitative outcome statement)
2	Number of graduate students involved and trained
3	Number of undergraduate students involved and trained

**Outcome #1**

**1. Outcome Target**

Increase in knowledge about hormonal control of reproduction and parental care in beetles (qualitative outcome statement)

**2. Outcome Type :** Change in Knowledge Outcome Measure

<b>2010 :</b> 0	<b>2011 :</b> 0	<b>2012 :</b> 0	<b>2013 :</b> 0	<b>2014 :</b> 0
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**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 215 - Biological Control of Pests Affecting Plants

**Outcome #2**

**1. Outcome Target**

Number of graduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010 :</b> 1	<b>2011 :</b> 0	<b>2012 :</b> 1	<b>2013 :</b> 0	<b>2014 :</b> 1
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**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 215 - Biological Control of Pests Affecting Plants

**Outcome #3**

**1. Outcome Target**

Number of undergraduate students involved and trained

**2. Outcome Type :** Change in Knowledge Outcome Measure

<b>2010 :</b> 1	<b>2011 :</b> 1	<b>2012 :</b> 1	<b>2013 :</b> 1	<b>2014 :</b> 0
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**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 215 - Biological Control of Pests Affecting Plants

**V(J). Planned Program (External Factors)**

**1. External Factors which may affect Outcomes**

- Appropriations changes
- Natural Disasters (drought,weather extremes,etc.)
- Competing Programmatic Challenges

**Description**

Natural disaster such as drought or floods would adversely affect the project, as would the loss of funding through appropriation changes. Budgetary pressures mandate that competing programs be prioritized to maximize relevance and productivity.

## **V(K). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- After Only (post program)
- During (during program)

#### **Description**

Effectiveness of the program will be assessed from annual reports and from comments and questions of manuscript and grant proposal reviewers and audiences at presentations.

### **2. Data Collection Methods**

- Sampling

#### **Description**

Data on program effectiveness will be collected from annual reports and from comments and questions of manuscript and grant proposal reviewers and audiences at presentations.

**V(A). Planned Program (Summary)**

**Program #8**

**1. Name of the Planned Program**

Plants & Plant Products

**2. Brief summary about Planned Program**

As we organize our agricultural programs to better undertake strategic initiatives, the number and categories of programs will change through time. We currently have three projects in this program, including: Iron deficiency and oxidative stress and the inhibition of photosynthesis, Potential phase I generalized stress response at the cellular and tissue level for sunflower leaves exposed to osmotic stress and mechanical injury, and Seaweed Biodiversity and Introduced Seaweeds Within the Gulf of Maine.

**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
136	Conservation of Biological Diversity			10%	
201	Plant Genome, Genetics, and Genetic Mechanisms			19%	
202	Plant Genetic Resources and Biodiversity			10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			25%	
206	Basic Plant Biology			12%	
502	New and Improved Food Products			6%	
701	Nutrient Composition of Food			18%	
	<b>Total</b>			100%	

**V(C). Planned Program (Situation and Scope)****1. Situation and priorities**

Iron scarcity in the oceans is known to be one of the two major limiting factors in primary productivity at the bottom of the food chain. The metabolic role of iron in both promoting and ameliorating oxidative stress is still poorly understood in photosynthetic organisms. This study will deal with a little studied aspect of plant stress response, that is cell and tissue structural responses to stress. It is needed to further our overall understanding of plant responses to stress and may affect the direction of plant breeding for enhanced resistance to various abiotic stresses.

**2. Scope of the Program**

- In-State Research

**V(D). Planned Program (Assumptions and Goals)****1. Assumptions made for the Program**

We hypothesize that iron deficiency will adversely affect the key anti-oxidant enzymes: superoxide dismutase, catalase and ascorbate peroxidase. We also suspect that it will cause a depletion of the key substrates ascorbic acid (vitamin C) and alpha-tocopherol (vitamin E). Different detection pathways will converge on a very limited number of cytological and tissue structural responses. Introduced/invasive species can be better contained or the impacts minimized based upon enhanced knowledge of their vectors and means of introductions.

**2. Ultimate goal(s) of this Program**

To allow meaningful predictions of the quantitative effects of iron limitation on net primary productivity due to oxidative stress. To understand the involvement of cell and tissue structural changes in response to plant stress and eventually the mechanism by which those changes are effected. To help maintain high diversity of critically important seaweed populations and reduce the occurrence of invasive/harmful taxa.

**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
2010	0.0	0.0	1.3	0.0
2011	0.0	0.0	1.3	0.0
2012	0.0	0.0	1.3	0.0
2013	0.0	0.0	1.0	0.0
2014	0.0	0.0	1.0	0.0

**V(F). Planned Program (Activity)****1. Activity for the Program**

Statistical analysis of quantitative cytological and tissue anatomical data will be made comparing stressed and control tissues to determine significant changes in structure, with an emphasis on chloroplast thylakoid structure. Assessment of diversity patterns will be made at multiple sites with varying anthropogenic impacts and numbers/types of introduced species within the Gulf of Maine. Antioxidant enzymes and substrates as well as overall photosynthetic competence will be measured under iron replete and various levels of iron deficiency.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● Group Discussion</li> <li>● Demonstrations</li> <li>● Other 1 (Laboratory research)</li> <li>● Other 2 (Scientific presentations)</li> <li>● Education Class</li> </ul>	<ul style="list-style-type: none"> <li>● Other 1 (Peer reviewed publications)</li> <li>● Web sites</li> <li>● Newsletters</li> </ul>

**3. Description of targeted audience**

Scientists dealing with micronutrient deficiencies and their effects on photosynthetic productivity, scientists and potentially plant breeders interested in abiotic stress in plants, plant physiologists, those involved with coastal zone management, conservation, etc.

**V(G). Planned Program (Outputs)****1. Standard output measures**

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	400	1500	10	0
2011	400	1500	10	0
2012	400	1500	10	0
2013	400	1500	0	0
2014	200	800	10	0

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

2010 :0

2011 :0

2012 :0

2013 :0

2014 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	5	0	5
2011	5	0	5
2012	5	0	5
2013	2	0	0
2014	2	0	0

**V(H). State Defined Outputs**

**1. Output Target**

● Number of participants directly involved in the project (not including audience counts, workshop participants, survey respondents, etc)	<b>2010</b> :15	<b>2011</b> :15	<b>2012</b> :15	<b>2013</b> :15	<b>2014</b> :10
● Number of undergraduate students directly involved in the projects	<b>2010</b> 5	<b>2011</b> 5	<b>2012</b> :5	<b>2013</b> 5	<b>2014</b> 4
● Number of graduate student directly involved in the projects	<b>2010</b> 5	<b>2011</b> 5	<b>2012</b> :2	<b>2013</b> 2	<b>2014</b> 2
● Number of non-peer-reviewed publications (theses, abstracts, newsletters, fact sheets, articles, etc)	<b>2010</b> 8	<b>2011</b> 8	<b>2012</b> :8	<b>2013</b> 8	<b>2014</b> 6
● Number of websites in which project results have been incorporated	<b>2010</b> 3	<b>2011</b> 3	<b>2012</b> :3	<b>2013</b> 2	<b>2014</b> 2
● Number of peer-reviewed publications	<b>2010</b> 2	<b>2011</b> 2	<b>2012</b> :2	<b>2013</b> 2	<b>2014</b> 2

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	Number of graduate students involved and trained
2	Number of undergraduate students involved and trained
3	Increase in knowledge to publications and other means

**Outcome #1****1. Outcome Target**

Number of graduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> 2	<b>2011</b> :2	<b>2012</b> : 2	<b>2013</b> 2	<b>2014</b> :2
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**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 136 - Conservation of Biological Diversity
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources and Biodiversity
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 206 - Basic Plant Biology
- 502 - New and Improved Food Products
- 701 - Nutrient Composition of Food

**Outcome #2****1. Outcome Target**

Number of undergraduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

<b>2010</b> 2	<b>2011</b> :2	<b>2012</b> : 2	<b>2013</b> 2	<b>2014</b> :2
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**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 136 - Conservation of Biological Diversity
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources and Biodiversity
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 206 - Basic Plant Biology
- 502 - New and Improved Food Products
- 701 - Nutrient Composition of Food

**Outcome #3****1. Outcome Target**

Increase in knowledge to publications and other means

**2. Outcome Type :** Change in Knowledge Outcome Measure

<b>2010</b> 0	<b>2011</b> :0	<b>2012</b> : 0	<b>2013</b> 0	<b>2014</b> :0
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**3. Associated Institute Type(s)**

•1862 Research

#### 4. Associated Knowledge Area(s)

- 136 - Conservation of Biological Diversity
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources and Biodiversity
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 206 - Basic Plant Biology
- 502 - New and Improved Food Products
- 701 - Nutrient Composition of Food

#### V(J). Planned Program (External Factors)

##### 1. External Factors which may affect Outcomes

- Economy
- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes
- Competing Programmatic Challenges

##### Description

For any field research in agriculture, extreme or anomalous weather conditions or natural disasters can interfere with work, or produce atypical results that require changes in research methodology or direction. Change in the economy can change regional priorities and necessitate refocusing research. The success of the research is highly dependent on continued funding of NHAES at a sufficient level. Budgetary pressures mandate that competing programs be prioritized to maximize relevance and productivity.

#### V(K). Planned Program (Evaluation Studies and Data Collection)

##### 1. Evaluation Studies Planned

- After Only (post program)
- During (during program)
- Time series (multiple points before and after program)
- Retrospective (post program)

##### Description

Evaluation of work will be based on peer review acceptance of manuscripts and papers, industry acceptance and application of results. . During each project, data are analyzed and research is evaluated.

##### 2. Data Collection Methods

- Sampling
- Observation
- Journals
- Other (Reviews)

##### Description

Feedback from target audiences (other scientists, students, etc) will be collected through questions and comments at meetings, proposal and manuscript reviews, and website stakeholder input tools.

**V(A). Planned Program (Summary)**

**Program #9**

**1. Name of the Planned Program**

Sustainable Horticulture

**2. Brief summary about Planned Program**

As we organize our agricultural programs to better undertake strategic initiatives, the number and categories of programs will change through time. We currently have six projects in this program, including: Cultural Factors Influencing Production and Landscape Establishment of Trees and Shrubs, Varieties and cultural practices for vegetable and small fruit production in New Hampshire, Establishing Production Guidelines for Osteospermum, Genomic Tools for Horticultural Crops: Development and Application, and Breeding for Nutritional Quality in Squash, and Conservation and Utilization of Plant Genetic Resources.

**3. Program existence :** Intermediate (One to 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			5%	
201	Plant Genome, Genetics, and Genetic Mechanisms			15%	
202	Plant Genetic Resources and Biodiversity			10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			10%	
204	Plant Product Quality and Utility (Preharvest)			15%	
205	Plant Management Systems			15%	
212	Pathogens and Nematodes Affecting Plants			5%	
502	New and Improved Food Products			6%	
503	Quality Maintenance in Storing and Marketing Food Products			4%	
701	Nutrient Composition of Food			15%	
	<b>Total</b>			100%	

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

#### 1. Situation and priorities

State and regional nurseries are at a competitive disadvantage in the market for landscape plants due to high costs of land, labor and other inputs. Most plants are imported into the region from southern and western production areas, so are not always well-adapted to our climate and soils. Horticultural crop production research is primarily undertaken in major production regions, most of which bear little resemblance to New Hampshire's climatic limitations and the small-scale nature of our agricultural enterprises. The cost of the production of greenhouse crops is rising steeply due to the cost of heating fuel and fertilizer. Osteospermum is a crop that shows potential of being grown at cooler temperatures than other greenhouse crops. Cooler growing temperatures and accurate fertilizer recommendations can greatly reduce the costs associated with production for growers resulting in higher profits. Horticultural productivity is constantly threatened by diseases, pests, and abiotic stresses. Opportunities exist to improve product quality. Genetic solutions can be sustainable and environmentally friendly. Substantial opportunity exists to fill new grower and marketing niches for specialty crops such as strawberry. Carotenoids have been shown to have beneficial anti-oxidant properties that can contribute to lower incidence of certain cancers and show an inverse correlation with cardiovascular disease. Lutein, a carotenoid present in high amounts in some squash cultivars, is one of the

two principle carotenoids comprising the macular region of the eye, and greater intake has been associated with reducing the risk of age-related macular degeneration. With high land values and expensive labor, vegetable growers must be able to successfully grow and market unique food products that have superior quality to that available through large traditional outlets in order to remain profitable. These efforts require continued improvement in varieties that are suitable to grower needs, and that require fewer cultural inputs and pesticide applications.

## 2. Scope of the Program

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

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

### 1. Assumptions made for the Program

Population growth in New Hampshire continues to spur residential and commercial development and associated landscaping, thus maintaining demand for landscape plants. The trends towards high energy costs, demand for local grown products, and interest in the environment continue. Varieties and growing practices that are suited to the New Hampshire climate will be identified. Fuel and fertilizer prices will remain constant or increase. A quality osteospermum crop can be produced at cooler than normal temperatures. Molecular tools will become increasingly attractive to plant breeders. Environmental challenges and new product opportunities will be ongoing and open-ended. Consumer consciousness of product quality and healthfulness will continue to increase. Regional growers will embrace new varieties selected for adaptation to sustainable (and where possible organic) production systems. We will be able to identify specific squash germplasm containing high contents of certain carotenoids such as beta-carotene and lutein, and to breed new varieties of winter squash that can be touted for their nutritional benefits. New varieties of melon, squash, pumpkins and gourds provide local growers with the means to expand market windows and offer a greater diversity of crops to the consumer than that available through large commercial supermarkets. Introduction of new varieties of acorn squash and ornamental pumpkin varieties that are resistant to powdery mildew decreases the inputs of pesticide application to those crops.

### 2. Ultimate goal(s) of this Program

To develop more efficient and economical production systems for nursery crops, resulting in lower production costs and more profitability for nurseries in the state and region. To identify highly profitable crops and varieties and to discover the most efficient ways to grow them with minimal environmental impact, which will result in increased farm production and income. To develop production guidelines for osteospermum which will require less heating fuel as well as recommend optimal fertilizer practices resulting in a high quality profitable crop with lower input costs. To develop genomic and germplasm resources for horticultural crops, with focus on strawberry and mint. To translate these basic resources into applicable tools for plant breeders. To identify or develop appropriate strawberry varieties and establish and demonstrate a practical system for production of high quality strawberry crops within a sustainable (and where possible organic) framework. To breed improved varieties of the three major species of squash that have an improved nutritional benefit in terms of carotenoid profiles. The nutritional status of such varieties can be used as a marketing tool for local markets. To provide growers with improved varieties that are more productive, have better eating and nutritional qualities, have better disease resistance than current varieties, and therefore can increase grower profits and provide better and healthier produce for the consumer. For example, new varieties and cultural techniques developed at University of New Hampshire have allowed growers to increase the market window for melons from two weeks to five weeks. Earlier maturing, more colorful and more productive egg and spoon gourds have given growers in northern New England an additional fall crop for roadside markets.

## 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
2010	0.0	0.0	2.4	0.0
2011	0.0	0.0	2.9	0.0
2012	0.0	0.0	2.9	0.0
2013	0.0	0.0	2.9	0.0
2014	0.0	0.0	2.0	0.0

### V(F). Planned Program (Activity)

#### 1. Activity for the Program

To evaluate growth response variables Min, max, and average temperatures in root zones of container grown plants, as well as duration of lethal cold temperatures. Compare plant survival and growth at the beginning and end of each growing season through direct measurement and observation. Monitor attendance at outreach events by direct observation. Gauge adoption of practices by surveys and unstructured interviews. Cleanse and sequence plant DNA, analyze DNA sequences using bioinformatic tools (computer programs), monitor plant populations in greenhouse and field, perform cross-pollinations to construct new hybrids for research use and evaluation. Undertake quantitative and qualitative phenotypic evaluation of plant germplasm, including wild material, hybrids, breeding populations. Acquire and analyze genomic DNA sequence information, conduct DNA sequence comparisons focused on the Rosaceae family, create plant hybrids, and evaluate promising selections in multiple locations. Monitor seed sales of high carotenoid varieties in different regions. It is anticipated that some high carotenoid varieties will be entered in All-America Selections variety trials, and this will give evaluations from several locations in North America. Continually evaluate new hybrids through replicated and non-replicated trials at numerous locations throughout North America and in some other countries such as New Zealand, South Africa, Japan, Mexico, and Canada. Between 100 and 200 experimental hybrid are expected to be evaluated annually.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● Demonstrations</li> <li>● Workshop</li> <li>● Education Class</li> <li>● Other 1 (Field and laboratory research)</li> <li>● One-on-One Intervention</li> </ul>	<ul style="list-style-type: none"> <li>● Newsletters</li> <li>● Web sites</li> </ul>

#### 3. Description of targeted audience

Fruit and vegetable growers throughout New England and the Northeast are the primary target, along with home gardeners and consumers of local farm products. Nursery owners, managers and growers in the state and region. Other researchers and undergraduate and graduate students in horticulture and sustainable agriculture.

### V(G). Planned Program (Outputs)

#### 1. Standard output measures

**Target for the number of persons(contacts) to be reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	300	500	0	200
2011	300	500	0	200
2012	200	500	0	200
2013	200	500	0	200
2014	300	500	0	200

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

**Expected Patent Applications**

2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	5	0	5
2011	3	0	3
2012	3	0	3
2013	3	0	0
2014	4	0	0

**V(H). State Defined Outputs**

**1. Output Target**

- Number of workshops and training sessions

2010 :4                      2011 :4                      2012 :4                      2013 :4                      2014 :4

- Number of participants in the project (not including audience counts)

2010 :10                      2011 :10                      2012 :10                      2013 :10                      2014 :10

- Number of undergraduate students involved in the research projects

2010 :5                      2011 :5                      2012 :5                      2013 :5                      2014 :5

- Number of graduate students involved in the research project2

2010 :2                      2011 :2                      2012 :2                      2013 :2                      2014 :3

- Number of non-peer reviewed publications (theses, abstracts, newsletters, fact sheets, articles, etc)

2010 :2                      2011 :2                      2012 :2                      2013 :2                      2014 :4

- Number of websites in which the project results are incorporated.

2010 :2                      2011 :2                      2012 :2                      2013 :2                      2014 :2

- Number of peer-reviewed publications

2010 2

2011 2

2012 2

2013 2

2014 2

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	Number of graduate students involved and trained
2	Number of undergraduate students involved and trained
3	Incureased knowledge through publications and other means
4	Develop new and improved horticultural products that are available to producers and consumers

**Outcome #1****1. Outcome Target**

Number of graduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure**2010** 2**2011** :2**2012** :2**2013** 2**2014** :2**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources and Biodiversity
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 212 - Pathogens and Nematodes Affecting Plants
- 502 - New and Improved Food Products
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 701 - Nutrient Composition of Food

**Outcome #2****1. Outcome Target**

Number of undergraduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure**2010** 4**2011** :4**2012** :4**2013** 4**2014** :4**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources and Biodiversity
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 212 - Pathogens and Nematodes Affecting Plants
- 502 - New and Improved Food Products
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 701 - Nutrient Composition of Food

**Outcome #3****1. Outcome Target**

Increased knowledge through publications and other means

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 0                      2011 :0                      2012 :0                      2013 0                      2014 :0

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources and Biodiversity
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 212 - Pathogens and Nematodes Affecting Plants
- 502 - New and Improved Food Products
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 701 - Nutrient Composition of Food

**Outcome #4****1. Outcome Target**

Develop new and improved horticultural products that are available to producers and consumers

**2. Outcome Type :** Change in Condition Outcome Measure

2010 2                      2011 :2                      2012 :2                      2013 2                      2014 :2

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 202 - Plant Genetic Resources and Biodiversity
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 502 - New and Improved Food Products
- 503 - Quality Maintenance in Storing and Marketing Food Products

**V(J). Planned Program (External Factors)****1. External Factors which may affect Outcomes**

- Economy
- Competing Programmatic Challenges
- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes

## Description

For any field research in agriculture, extreme or anomalous weather conditions or natural disasters can interfere with work, or produce atypical results that require changes in research methodology or direction. Change in the economy can change regional priorities and necessitate refocusing research. The success of the research is highly dependent on continued funding of NHAES at a sufficient level. Budgetary pressures mandate that competing programs be prioritized to maximize relevance and productivity.

## V(K). Planned Program (Evaluation Studies and Data Collection)

### 1. Evaluation Studies Planned

- Other (see below)
- During (during program)
- After Only (post program)

#### Description

The Horticulture program will be evaluated based on accomplishment of its research goals and on how well it has address the issues and met the needs of its target audience. Feedback from growers groups, the NHAES External Advisory Committee and other stakeholders during and after the studies will be considered.

### 2. Data Collection Methods

- Unstructured
- Sampling
- Other (meetings & website)
- Observation

#### Description

Feedback from target audiences (growers, nursery professionals, landscapers, seed companies, home gardeners, etc) will be collected through meetings and website stakeholder input tools.

**V(A). Planned Program (Summary)**

**Program #10**

**1. Name of the Planned Program**

Sustainable Marine Aquaculture & Fisheries

**2. Brief summary about Planned Program**

The global demand for seafood has increased steadily, while for the past 18 years, the amount of seafood harvested from wild populations has remained level or declined. Increased demand has been met entirely through marine aquaculture, which is presently a multi-billion dollar industry. The United States is a major consumer of marine aquaculture products, yet we grow only a tiny fraction of global production and indeed only a small fraction of what we consume. A significant obstacle to the growth of a U.S. marine aquaculture industry has been the need to find environmentally sustainable methods of farming fish. Part of the issue is that marine aquaculture operations in the Northeast have focused on finfish production (mostly salmon) in coastal net-pen systems. There are nutrient discharge issues, protein source issues, disease issues and a number of other concerns. The goal of the Sustainable Aquaculture & Marine Fisheries Program is to find solutions to the issues and lay the groundwork for the growth of the industry in the Northeast.

**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
135	Aquatic and Terrestrial Wildlife			20%	
301	Reproductive Performance of Animals			10%	
302	Nutrient Utilization in Animals			7%	
304	Animal Genome			8%	
305	Animal Physiological Processes			22%	
307	Animal Production Management Systems			8%	
308	Improved Animal Products (Before Harvest)			10%	
311	Animal Diseases			15%	
	<b>Total</b>			100%	

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

#### 1. Situation and priorities

New England has the natural resources to support a strong, economically and environmentally sustainable marine aquaculture industry and fishery, but it has not yet adopted the correct approach. The problem is that the marine aquaculture industry in the Northeast, and indeed in much of North America, has been interested primarily in growing fish, and very few species of fish at that. In addition to the tremendous financial risk of basing an industry on a single species, the production of fish creates several environmental problems. One is that fish, like any animal, produce metabolic waste. In coastal waters, the nutrient in fish aquaculture effluent can create environmental problems including blooms of toxic and nuisance algae. Secondly, aquaculture fish feed contains high levels of protein (~50%). The protein source for marine fish diets is fishmeal, which general comes from wild harvested sardines and anchovies. These fisheries are fully exploited and will not support the project global growth of aquaculture. So there is a need for alternate, sustainable sources of protein. There are also disease issues that can be devastating to an aquaculture industry build on one or few species. The key to a sustainable marine aquaculture industry is diversification and the integration of fed species, like fish with extractive species, like mollusks and commercially important seaweeds.

Capture marine fisheries in the Northeast overall have declined significantly since the mid-1900s. One salient exception is the New England lobster industry. Commercial landings of lobster from the Gulf of Maine have doubled since 1981 and are now at 35,000 Metric Tonnes per year. Part of the success is the result of good fishery management based on scientific knowledge. Some of this knowledge has come from ongoing NHAES supported research.

The priorities of the NHAES are to support research and technology development that leads to diversification and

development of sustainable marine aquaculture systems and good management practices for marine fisheries.

**2. Scope of the Program**

- Multistate Research
- In-State Research

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

**1. Assumptions made for the Program**

The major steps for sea urchin aquaculture are known and well documented, but adapting these approaches to local conditions must be accomplished. The local sea urchin *Strongylocentrotus droebachiensis* has very high market appeal in Japan, the major market for sea urchin roe or gonads. Understanding clam leukemia at the molecular level may ultimately permit us to prevent or treat this disease. Fishermen will benefit and clam beds closed for years such as in NH (since 1951) can be utilized again. Spawning stocks will exhibit differential expression of antifreeze proteins. While the lobster fishery is currently healthy, there is concern that we are overfishing the resource. There is also concern that the fishery is currently very sensitive to environmental changes, as indicated by the brief collapse of the fishery in southern New England a few years ago. Our knowledge of lobster biology and ecology is only fair and not sufficient to guide effective management of the species. For example, we do not know where new recruits to fishery come from and what habitats need to be protected in order to maximize female reproductive potential. A basic understanding of the molecular basis for host adaptation in bacteria will aid in developing predictive models for emergent pathogens in aquaculture. These may lead to the prevention of disease outbreaks in aquaculture and natural fisheries. Bacteria in the genus *Vibrio* will adapt to new hosts over time from exclusive contact.

**2. Ultimate goal(s) of this Program**

The ultimate goal of the program is to provide research and develop technology that will allow the establishment of a strong integrated multi-trophic aquaculture industry in the Northeast, and to provide research that leads to effective management of marine fisheries. Specific goals include: To develop an economically viable sea urchin aquaculture industry in the New England Region. Based on the results from this study and others like it, to tackle the more difficult problem of successfully treating large numbers of soft shell clams affected by this common disease that devastates clam beds in northeastern US and Canada. To increase commercial aquaculture growth of Atlantic cod. To evaluate the factors that determine the movement and distribution of lobsters in coastal and estuarine habitats. In addition, to determine if some types of lobsters respond to environmental cues, such as thermal gradients, in unique and predictable ways. For example, it is critical to determine the factors that influence the movements of female lobsters with eggs, because they are the source of all new recruits to the fishery. To determine, in the laboratory, if different lobster life history stages (females with eggs, reproductive lobsters, etc.) respond differently to thermal gradients, such as those that exist in an estuary. To measure the movements of those same animals in a natural thermal gradient, using ultrasonic telemetry, to determine if they move as predicted in the laboratory. To determine if the skewed sex ratio documented in some regions of the fishery, such as within the Great Bay estuary, is due to differential movements of reproductive males and females. To evaluate the mechanisms by which bacteria expand host range and adapt to infect new hosts. To understand the molecular mechanisms and evolutionary processes of host range expansion in bacteria.

**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
2010	0.0	0.0	1.6	0.0
2011	0.0	0.0	1.6	0.0
2012	0.0	0.0	1.6	0.0
2013	0.0	0.0	1.6	0.0
2014	0.0	0.0	1.5	0.0

**V(F). Planned Program (Activity)**

**1. Activity for the Program**

Conditions within the lease sites that may impact urchin population health and growth will be monitored and evaluated by periodic surveys with special emphasis on invasive species that are increasing in the Gulf of Maine. Complete molecular and microscopic analysis of effects of treatments of leukemic clams with anti-cancer agents. Monitor antifreeze protein in controlled experiments with two spawning stocks of Atlantic cod. Each year 40 lobsters will be tracked in the Great Bay estuary using ultrasonic telemetry techniques. We will use the following groups: 10 male and 10 female sexually mature lobsters, 10 male and 10 female immature lobsters. We will measure the direction and distance they travel each month and determine if there are statistically significant differences between any of the groups. We will also measure the thermal preferences of the lobsters of the same type in the laboratory and we will determine if there are differences in the thermal preferences, between groups, at different times of the year. Phenotypic tests will be completed, genetic analysis (whole genome re-sequencing) will be performed. Adaptation will be assessed at the conclusion of the experiment, and trait adaptation will be quantified at several time points.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● Other 1 (Field &amp; Lab research)</li> <li>● Other 2 (Scientific Presentations)</li> <li>● Workshop</li> <li>● Demonstrations</li> <li>● Group Discussion</li> <li>● Education Class</li> </ul>	<ul style="list-style-type: none"> <li>● Web sites</li> <li>● TV Media Programs</li> </ul>

**3. Description of targeted audience**

Members of the sea urchin fishery and fisheries managers, particularly in the State of Maine and also members of the aquaculture industry, scientists working on sea urchin ecology, physiology and aquaculture production, lobstermen, managers, lobster biologists, marine ecologists, scientists, researchers, teachers, students and the general public.

**V(G). Planned Program (Outputs)**

**1. Standard output measures**

**Target for the number of persons(contacts) to be reached through direct and indirect contact methods**

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	200	1000	15	100
2011	100	1000	0	0
2012	100	200	0	0
2013	0	0	0	0
2014	0	0	0	0

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

**Expected Patent Applications**

2010 :0                      2011 :0                      2012 :0                      2013 :0                      2014 :0

**3. Expected Peer Review Publications**

Year	Research Target	Extension Target	Total
2010	7	0	7
2011	4	0	4
2012	2	0	2
2013	2	0	2
2014	2	0	0

**V(H). State Defined Outputs****1. Output Target**

- Number of participants in the project (not including audience counts)

**2010** :16                      **2011** :10                      **2012** :10                      **2013** :10                      **2014** :8

- Number of undergraduate students directly involved in the projects

**2010** :5                      **2011** :3                      **2012** :3                      **2013** :2                      **2014** :4

- Number of graduate student directly involved in the projects

**2010** :4                      **2011** :2                      **2012** :2                      **2013** :2                      **2014** :3

- Number of non-peer-reviewed publications (theses, abstracts, newsletters, fact sheets, articles, etc)

**2010** :8                      **2011** :5                      **2012** :5                      **2013** :5                      **2014** :5

- Number of websites in which project results have been incorporated.

**2010** :4                      **2011** :4                      **2012** :4                      **2013** :4                      **2014** :2

- Number of peer-reviewed publications

**2010** :2                      **2011** :2                      **2012** :2                      **2013** :2                      **2014** :2

**V(I). State Defined Outcome**

<b>O. No</b>	<b>Outcome Name</b>
1	Number of graduate students involved and trained
2	Number of undergraduate students involved and trained
3	Increased knowledge through publications and other means

**Outcome #1**

**1. Outcome Target**

Number of graduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

**2010** 3                      **2011** : 3                      **2012** : 3                      **2013** 3                      **2014** :3

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife
- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 304 - Animal Genome
- 305 - Animal Physiological Processes
- 307 - Animal Production Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases

**Outcome #2**

**1. Outcome Target**

Number of undergraduate students involved and trained

**2. Outcome Type :** Change in Action Outcome Measure

**2010** 4                      **2011** : 4                      **2012** : 4                      **2013** 4                      **2014** :4

**3. Associated Institute Type(s)**

•1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife
- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 304 - Animal Genome
- 305 - Animal Physiological Processes
- 307 - Animal Production Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases

**Outcome #3**

**1. Outcome Target**

Increased knowledge through publications and other means

**2. Outcome Type :** Change in Knowledge Outcome Measure

2010 0

2011 :0

2012 :0

2013 0

2014 :0

**3. Associated Institute Type(s)**

- 1862 Research

**4. Associated Knowledge Area(s)**

- 135 - Aquatic and Terrestrial Wildlife
- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 304 - Animal Genome
- 305 - Animal Physiological Processes
- 307 - Animal Production Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases

**V(J). Planned Program (External Factors)****1. External Factors which may affect Outcomes**

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

**Description**

For any field research in agriculture, extreme or anomalous weather conditions or natural disasters can interfere with work, or produce atypical results that require changes in research methodology or direction. Change in the economy can change regional priorities and necessitate refocusing research. The success of the research is highly dependent on continued funding of NHAES at a sufficient level. Budgetary pressures mandate that competing programs be prioritized to maximize relevance and productivity.

**V(K). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

- After Only (post program)
- During (during program)
- Retrospective (post program)
- Other (see below)
- Before-After (before and after program)

**Description**

The Sustainable Marine Aquaculture and Fisheries program will be evaluated based on accomplishment of its research goals and on how well it has address the issues and met the needs of its target audience. Feedback from scientists, aquaculture operations, regulatory agencies, the NHAES External Advisory Committee and other stakeholders will be considered.

## 2. Data Collection Methods

- Sampling
- Other (meeting & website)
- Observation
- Unstructured

### Description

Feedback from target audiences (fish hatcheries, aquaculture operations, regulatory agencies, other scientists, students, etc) will be collected through questions and comments at meetings, proposal and manuscript review, and website stakeholder input tools.