2014 University of New Hampshire Research Plan of Work

Status: Accepted

Date Accepted: 06/04/2013

I. Plan Overview

1. Brief Summary about Plan Of Work

The New Hampshire Agricultural Experiment Station (NHAES) resides within the University of New Hampshire's College of Life Sciences and Agriculture. NHAES is responsible for the funding of Hatch and Hatch-Multistate agricultural research and McIntire-Stennis cooperative forestry research programs. This report covers the federal and state partnership-funded Hatch and Hatch-Multistate research components. Our programs are inclusive of the USDA-NIFA priority programs in (childhood) obesity, climate change, food safety, and global food security & hunger and also address important state and regional priorities in sustaining natural resources (McIntire-Stennis) and supporting rural economies (Hatch, Hatch-Multistate). In addition, NHAES is working with the Maine Agricultural and Forestry Experiment Station and the Vermont Agricultural Experiment Station through the Northern New England Collaborative Research Funding Program.

We focus on research problems that have local to international relevance and are closely mindful of the Hatch Act directive, which asserts that the experiment stations are best able to prioritize specific research needs for their respective states. The diverse funding portfolio of our researchers demonstrates the success of NHAES foundational support and investments, leading to strong productivity and the ability of scientists to further leverage their research findings into federal grants activity. This results in strong added value for NH taxpayers. The Hatch capacity funds provide a critical baseline capability to support credible agricultural programs, including the field research facilities and support for training the next generation of agricultural scientists and educated citizen consumers.

Agriculture and associated natural resources are core contributors to the NH economy. The value of NH Agriculture in fiscal year 2009 was $636 million, reduced from a high of $935 million. Much of the decline was due to the crash of the housing market and resulting decreases in landscaping plants. Ornamental horticulture and dairy have the largest market share of the NH Agricultural Economy. Over the last four years, the value of NH agriculture has rebounded with the waning of the Great Recession. Further a study by UNH in 2009 found that almost 60% of NH residents feel that agriculture is important in maintaining New Hampshire's economy (up from 50% in 2007). Beyond the direct impacts of agricultural cash receipts and its multipliers, the attractive open spaces maintained by pastoral small-scale agricultural operations combine with our abundant natural resource base to create a compelling venue in support of our large tourism sector. Agricultural tourism contributes to thousands of jobs and an estimated $141 million in government receipts (property taxes, rooms and meals taxes, etc.). The same quality of life factors provide a magnet for the growing high-technology industrial base, a biomedical industry, and additional sectors of the state's economy.

In agriculture, the trend in our state continues to be toward smaller farms with income balanced between crop and livestock sales. The number of farms in NH has increased 24% from 2002 to 2007 (USDA Agricultural Census). New recruits are setting up small diversified farms. The New England dairy industry continues to suffer the impacts of low milk prices. We rank high nationally in proportion of organic farms and the value of organic as percent of total sales, consistent with our small producers seeking viable economic niches. The latter is aided through the close proximity of many New England urban and rural interfaces. Twenty four percent of farms have direct sales; NH ranks #3 of all states in direct market sales

as a percentage of all farm sales. NH's Hillsborough and Rockingham Counties are #37 and #38 respectively in the top counties in the U.S. in direct market sales. We strongly support the agricultural and natural resource enterprises through our suite of funded projects and through Cooperative Extension trials on our two horticultural/agronomy farms, two dairies and research greenhouses. The farms and dairies address both conventional and organic research and management needs, the results of which are disseminated to our varied stakeholders. Our setting on the Gulf of Maine provides an opportunity to support coastal and open water marine aquaculture through research and meaningful engagement with producers, harvesters and other stakeholders.

The overarching goal of our planned program areas is to provide a balance that spans the range of fundamental (development) to applied (applications-oriented) research in support of important state, regional and national agricultural issues. Our research, outreach, and educational programs will emphasize the sustainability of our relatively unique small scale and diversified agricultural operations, and will contribute to the development of a highly competitive agricultural system for local and regional markets. At the same time we continue to be strong contributors to the economic engine supporting a diversity of related New Hampshire businesses and citizens.

Scientists at the New Hampshire Agricultural Experiment Station are encouraged to coordinate their research activities with scientists at other stations in the northeast region, through collaboration in Multi-State Hatch projects and via the USDA National Institute of Food and Agriculture. Further, the Northern New England Collaborative Research Funding Program is a new partnership of the Maine Agricultural and Forest Experiment Station, New Hampshire Agricultural Experiment Station, and Vermont Agricultural Experiment Station. The goal of the program is to catalyze coordinated regional research with high priority needs for the northern New England region in experiment station mission areas. The priority for the first round of applications are proposals that have high potential to significantly improve our understanding of the impacts of climate variability and change on agriculture in the region, help farmers adapt to future climate variability and change, and/or inform farmers on alternatives for mitigating the impacts agriculture has on climate change and variability.

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

Year	Extension		Research	
	1862	1890	1862	1890
2014	0.0	0.0	28.3	0.0
2015	0.0	0.0	27.8	0.0
2016	0.0	0.0	27.8	0.0
2017	0.0	0.0	27.8	0.0
2018	0.0	0.0	27.8	0.0

II. Merit Review Process

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

- Internal University Panel
- Expert Peer Review
- Other (Peer review of proposals, manuscripts and products)

2. Brief Explanation

NHAES station projects: Faculty are encouraged to submit a one page description of their proposed project and meet with the NHAES Associate Director/Faculty Fellow to discuss the anticipated work. Faculty are encouraged to use REEport and NIMSS to identify related research at other agricultural experiment stations. A proposal development and projects review manual is available online to help faculty prepare their full proposals.

All submitted proposals are critically reviewed for merit by a committee consisting of highly accomplished faculty members, plus the Director and Associate Director/Faculty Fellow. In response to stakeholder input, the NHAES review process now includes the following proposal evaluation criteria:

- Relationship to the Hatch or Hatch-Multistate programs, and to the NHAES mission and research priorities
- Scientific and technical merit
- Soundness of approach, procedures and methodology
- Likelihood of significant contributions and/or innovative advances
- Previous and current research productivity and accomplishments (or potential, for new investigators)
- Likelihood of significant enhancement in research capability and competitiveness.

The NHAES Director and Associate Director/Faculty Fellow use these recommended criteria and their own independent evaluation to make the final decision on which projects the Experiment Station will forward to NIFA for ultimate approval of funding.

Qualitative overview of the internal NHAES merit review process comes via the scholarly peer review process, which evaluates the manuscripts from NHAES projects and the ability of our scientists to compete for external funding. As appropriate to the proposed research, other activities are considered such extension and outreach, training of undergraduates and graduate students, and incorporation into University courses.

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?

NHAES funds participation in multi-state projects of significant concern, or potential impact, to the state of New Hampshire, the region, and nationally, which are broadly important to agriculture and citizens. Projects address aspects of animal and plant agriculture that include the breeding of suitable varieties for our area, improvement of immune responses in chicken, climate change, sustainable agriculture, and supporting economies on rural communities. The following projects will be active during FY2013 through FY2017:

- NE009 (through FY2017): Conservation and utilization of plant genetic resources
- NE1034 (through FY2013): Genetic bases for resistance and immunity to avian diseases
- NRSP3 (through FY2014): The National Atmospheric Deposition Program
- NC1042 (through FY2013) : Management systems to improve the economic and

environmental sustainability of dairy enterprises

- NE1039 (through FY2014): Changing the health trajectory for older adults through effective diet and activity modifications

We actively encourage multistate project participation, particularly among our best and junior scientists. Such affiliation with appropriate multistate research projects supports regional or national research priorities and, concurrently, benefits junior faculty by encouraging their interactions with scientific peers. One of our recent hires joined NE1047, "Ecological bases for weed management in sustainable cropping systems," while another has joined S1053, "Ecological and genetic diversity of soilborne pathogens and indigenous microflora."

The Director's Office and faculty members maintain connections to critical issues through fostering professional contacts with varied stakeholders, keeping abreast of priorities expressed by funding entities, collaborating with regional and national peers, and interacting directly with stakeholders - in particular farmers and other producers - about research imperatives.

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

Several of the planned programs for NHAES research address the needs of under-served and under-represented populations across the state; these include rural communities with emphasis on those in Northern New Hampshire. The immediate and long-term results of NHAES research impacts small farmers working traditional and organic dairies, the fledgling aquaculture industry along the New Hampshire seacoast, and a growing immigrant population in Manchester from refugee resettlement programs. We will work with our cooperative extension partners to more closely evaluate the needs of the state's urban populations, i.e. Manchester, within these categories.

Many of the multistate projects address priority needs that impact these target groups. Ongoing research investigates the availability and intake of healthy foods, links between environmental and dietary influences and obesity, and the viability of local products and markets. Multi-state NC1193 seeks to understand how issues important to young adults, such as environment and quality of life, affect their diet, activity, and lifestyle choices. As a participant in NC1193, researchers are surveying University students to assess and improve their nutrition environment. Outcomes will include targeted educational materials and interventions to help college age students improve their nutrition and maintain healthy weights. NC1171 will provide data for customizing programs and public policy to meet the needs of rural America. It also will inform the research and cooperative extension programming in sociology, economics, family studies, nutrition and health offered to families and communities across the state. Stakeholders have identified the needs for multi-state NE1039 as inadequate diet and lack of physical activity. NHAES investigators are testing an educational program to encourage consumption of whole grain foods by older adults. This, along with the other objectives of NE1039, should improve the health and vitality among older adults, who are the most rapidly growing segment of our population.

The Northeast produces approximately 25% of the organic milk in the country and the market has seen strong increases of the last decade. Organic dairy farmers remain an under-served population. The NHAES Organic Dairy Research facility is the only facility of its kind in the Northeast. NHAES is leading research efforts to reduce the costs of inputs (e.g., bedding and forage), improve grazing, and enhance the nutritional quality of milk products. NHAES scientists are leading a multi-investigator, integrated project supported by the Organic Research and Extension initiative (OAREI) to improve the quality, production, and marketing of milk.

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

We are training the principle investigators of all NHAES projects to focus on the outcomes and impacts of their active - and proposed - research. As we move forward with this initiative, the researchers will be progressively more aware of and able to identify these metrics and to report them during the annual cycle. Our web-based system for annual reporting, with drop down menus for examples of outcomes and impacts, has undergone three years of testing. We will continue to refine this online reporting system that enables principle investigators to more effectively track research outputs, outcomes, and engagement with stakeholders in order to communicate NHAES achievements to NIFA.

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

Interaction with multistate colleagues provides synergies, opportunity for professional growth and development, and, ultimately, the potential for enhanced individual effectiveness that will carry into all activities undertaken by researchers through the NHAES.

In addition to these formal multistate committee interactions, NHAES faculty participate broadly in regional, national, and international research collaborations of value to the state and region. Our new agricultural ecosystems faculty have initiated partnerships with researchers and cooperative extension faculty in Maine, Vermont, and other Agricultural Systems by preparing proposals to the Organic Agriculture Research and Extension Initiative (OREI) and Sustainable Agriculture Research and Education organization (SARE). These new collaborations strongly leverage NHAES support with substantial amounts of competitive funding that is directed to common themes of strategic importance.

Participation in multistate and integrated research projects provides participating faculty with multiple benefits, including the ability to undertake and accomplish projects with a larger and more integrated scope. Whether multistate, integrated or other, all our programs emphasize potential effectiveness and efficiency in order to maximize outcomes and impacts. NHAES only supports scientists who use taxpayer funds in a productive manner. We target our funding to strongly support and enhance productive research, and to develop more cohesive programmatic efforts where we can utilize our relative strengths in order to provide significant advances.

IV. Stakeholder Input

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

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

- Other (Comments from proposal and manuscript reveiwers,)

Brief explanation.

Input from our multiple stakeholders is encouraged at every opportunity and by multiple means, including presentations and meetings with traditional and non-traditional groups and individuals. Many of these are informational interactions, both opportunistic and planned, and others follow more formal routes. Input from stakeholders to individual faculty and NHAES projects is encouraged by surveys (telephone, in person, and web-based), through presentations at scientific conferences, extension/educational workshops and field days, multistate project meetings, mass media, publications, and university classroom and educational programs aimed at K-12. Nontraditional stakeholders are being increasingly engaged to inform and assist in our efforts to emphasize sustainable agricultural and food systems research. At the same time, we continue to nurture our communications with conventional agricultural stakeholders, who continue to be highly interested in and supportive of our work.

UNH Cooperative Extension (UNHCE) underwent a major restructuring in 2012. NHAES continues to support UNHCE by funding and managing the farms, dairies, and the greenhouse complex. NHAES researchers take part in UNHCE workshops and field days, while UNHCE takes part in NHAES research field days. Many of the members of the agroecology cluster hire (2009-2012) have close ties to extension educators and areas of synergies continue to grow.

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

1. Method to identify individuals and groups

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

Brief explanation.

The NHAES will continue to undertake strategies to identify and engage stakeholders from throughout New Hampshire, and to collect and incorporate input from them. The resulting information will be evaluated to identify the most critical and feasible issues for which we may develop effective contributions. UNH Cooperative Extension; the NH Department of Agriculture, Markets and Food; and the various college and NHAES advisory committees have been helpful in identifying traditional and non-traditional stakeholders. Meetings with groups of stakeholders often result in the identification of additional potential contacts. Attending and presenting at agricultural exhibitions, such as the annual NH Farm & Forest Expo, and the winter conference for the Northeast Organic Farming Association of NH (NOFA-NH), enables us to facilitate direct conversations with a very diverse group of stakeholders and rural citizens. Listening to and speaking with participants during field days and open houses, and commodity or 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 with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public
- Other (peer review on manuscripts submitted for publication)

Brief explanation.

For strategic planning and the development of NHAES programs and priorities, input is collected 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 and extension administrators, research project directors, graduate and undergraduate students, and other means. While most meetings are open discussions, some are presentations followed by questions and answer sessions. Members of the NHAES administration also attend extension events and take advantage of these opportunities to participate in discussions with groups and individuals.

We continue to add content to the Agriculture and Research sections of the college website to make agriculture much more prominent, visible, and accessible in order to encourage stakeholder interactions. Video tours are available for both dairies, horticulture/agronomy farms, and the MacFarlane Greenhouses (http://www.colsa.unh.edu/aes/facilities). NHAES research project participants obtain direct and indirect stakeholder input through varied avenues. In the next year, we will begin to post online versions of NHAES presentations made at the education session of the NH Farm and Forest Expo, and will look for other opportunities to use the web to make current research outcomes available to our stakeholders. Projects with social science components frequently use questionnaires and surveys. Stakeholder input to many basic and some appliedscience projects occurs in the form of reviewer inputs to proposals and manuscripts, and from the questions, comments, and discussions following presentations at regional, national, and international conferences. Stakeholder input is also collected directly through the questions and comments 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
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans

- To Set Priorities
- Other (Strategic Initiatives Development)

Brief explanation.

Formal and informal stakeholder input to faculty, staff, and administrators is very helpful in gauging the changing needs, constraints, and opportunities that we might address. These influence the specific activities of supported researchers as well as NHAES goals and directions in the short and long term.

Stakeholder input is used to continually review and update research priorities, relevant existing and emerging topics, and individual and programmatic performance. This information informs those activities that include faculty and staff hires as well as investments to our facilities and programs. Our strategies, activities, and priorities are dynamic and evolve with consideration of stakeholder input, institutional and societal goals and funding, and additional factors. We are continually working to facilitate constituent input, focus our resources on priority issues, and improve our delivery of research findings to end users.

V. Planned Program Table of Content

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

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Childhood Obesity

2. Brief summary about Planned Program

Nutrition and lifestyle conditions, which impact childhood obesity and obesity in all age groups, are a national research priority with direct impacts on New Hampshire citizens. There has been an upward trend, associated with the obesity crisis, in childhood respiratory allergy and asthma over the past 40 years. Dietary factors that have been suspected to be a cause of respiratory allergy and asthma is the imbalance of dietary levels of omega 6 versus omega 3 polyunsaturated fatty acids and/or levels of conjugated linoleic acid. The imbalance in these pro-inflammatory and anti-inflammatory fatty acids is believed to be, in part, the result of eating meat products and milk fat from farm animals that have been fed cereal grains instead of grazing on pasture. Ninety-nine percent of meat production farm animals in the U.S. are fed cereal grains. Using feeding studies in lab mice, one NHAES project is testing the hypothesis that the ratio of omega-6 to omega 3 polyunsaturated fatty acids and/or CLA levels are correlated with increased allergy and asthma.

In addition, NHAES researchers are collaborating in the multi-state project NE1039 to use diet and modified activity to improve the overall health profile of older adults. A whole grain education program for older adults will be tested to evaluate whole grain impacts on health. This multi-state project will also explore alternative, web-based methods to deliver nutrition education to older adults who may not be able to travel to testing centers.

There is accumulating evidence that epigenetics are another piece of the puzzle as to underlying causes of obesity. Epigenetics refers to transitory changes in chromatin (protein + DNA) that influence how genes are expressed. NHAES scientists conducting discovery research will look at epigenetics modifications in cultured fat cells.

Additional research related to nutrition, but which does not focus on obesity, is housed under the global food security and hunger planned program.

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 : No

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
305	Animal Physiological Processes			33%	
701	Nutrient Composition of Food			33%	
702	Requirements and Function of Nutrients and Other Food Components			34%	
	Total			100%	

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

1. Situation and priorities

Obesity is a global, growing epidemic recognized as a priority area by the USDA. Despite the plethora of resources devoted to understanding the roles of diet and exercise in the obesity epidemic, this epidemic continues to escalate. The drivers of obesity may be complex, and include changes in the biochemical properties of food we eat (for example, the ratio of omega 6 to omega 3 fatty acids) and the way our genes respond to that food.

2. Scope of the Program

- In-State Research
- Multistate Integrated Research and Extension

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

1. Assumptions made for the Program

The overriding assumption made for this program: Funding and resources will be available to continue this research.

Other assumptions made for this program are that:

- over the last century changes in production agriculture and food processing have subtly impacted how children and adults metabolize and store food energy,
- these changes in the food that most Americans eat have also contributed to the rising rate of childhood allergies and asthma,
- part of the obesity epidemic is due to epigenetic changes in how our bodies respond to food,
- effective diet and activity modifications will modify the health trajectory for older adults.

2. Ultimate goal(s) of this Program

The goals of research and extension activities on obesity are:

- increased knowledge of epigenetic changes in fat cells that may act as drivers in the obesity epidemic,
- increased understanding of how the modern American diet influences childhood allergies and asthma,

• effective education interventions to modify diet and physical activities in older adults that results in improved health trajectories.

V(E). Planned Program (Inputs)

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

Year	Extension		Research	
	1862	1890	1862	1890
2014	0.0	0.0	0.6	0.0
2015	0.0	0.0	0.6	0.0
2016	0.0	0.0	0.6	0.0
2017	0.0	0.0	0.6	0.0
2018	0.0	0.0	0.6	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

NHAES researchers will:

• use mass spectrometry data to quantify changes epigenetic changes in chromatin (modification of protein and DNA) of cultured mouse fat cells, and compare these changes in different nutritional states;
• examine the effects of inflammatory omega-6 fatty acids and non-inflammatory omega-3 fatty acids, from dairy fats, on the development of respiratory allergy in an animal model;
• compare dairy fats of milk from conventional total mixed ration-fed cows, which are known to be higher in omega-6 fatty acids, with that of pasture-fed organic dairy cows, which are known to be higher in omega-3 fatty acids;
• develop community-based education programs to improve diet and activity in older adults, which can be refined and evaluated in future projects.

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

Extension

Direct Methods	Indirect Methods
● Education Class ● Workshop ● Demonstrations ● Other 1 (Surveys) ● Other 2 (online education modules)	● Newsletters ● Web sites other than eXtension ● Other 1 (Social media)

3. Description of targeted audience

This project is intended to benefit the health of people across New Hampshire and the region, while

making the conduct of scientific research more transparent to community partners, stakeholders, and the public.

V(G). Planned Program (Outputs)

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

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

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

V(H). State Defined Outputs

1. Output Measure

- Number of undergraduate students directly involved in the projects
- Number of university courses in which project results have been incorporated
- Number of presentations at regional, national, or international scientific meetings
- Number of surveys or other means of gathering information and data from participants
- Number of reviewed, bulletin, popular and other publications
- Number of graduate students directly involved in the research.
- Number of websites in which project results have been incorporated

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

V(I). State Defined Outcome

O. No	Outcome Name
1	Number of graduate students trained and ready to enter the workforce.
2	Number of undergraduate students involved and trained in engagement research.
3	Evaluate the hypothesis: Milk fat consumption of pasture-fed cows will have a more protective effect against development of allergy development than milk fat cows fed a total mixed ration diet.
4	Enhanced understanding of epigenetic processes in cultured fat cells that may influence fat accumulation
5	Measurable improvement in dietary consumption of whole grains by older adults participating in whole grains foods education training

Outcome # 1

1. Outcome Target

Number of graduate students trained and ready to enter the workforce.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 305 - Animal Physiological Processes

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

Number of undergraduate students involved and trained in engagement research.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 305 - Animal Physiological Processes
- 702 - Requirements and Function of Nutrients and Other Food Components

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Evaluate the hypothesis: Milk fat consumption of pasture-fed cows will have a more protective effect against development of allergy development than milk fat cows fed a total mixed ration diet.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 305 - Animal Physiological Processes
- 701 - Nutrient Composition of Food
- 702 - Requirements and Function of Nutrients and Other Food Components

4. Associated Institute Type(s)

- 1862 Research

Outcome # 4

1. Outcome Target

Enhanced understanding of epigenetic processes in cultured fat cells that may influence fat accumulation

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 702 - Requirements and Function of Nutrients and Other Food Components

4. Associated Institute Type(s)

- 1862 Research

Outcome # 5

1. Outcome Target

Measurable improvement in dietary consumption of whole grains by older adults participating in whole grains foods education training

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 701 - Nutrient Composition of Food
- 702 - Requirements and Function of Nutrients and Other Food Components

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations

- Competing Public priorities
- Competing Programmatic Challenges

Description

Changes in funding and resource availability for the activities, and in policies or regulations related to research using animal and human subjects, would compromise the feasibility of completing the objectives. The current Federal and State budgetary limitations, combined with previous reductions in NHAES capacity funds, will impact the direct support of personnel, or facilities and limit our abilities to complete the proposed research.

Competing programmatic challenges must be considered in prioritizing resource use. Any changes in this situation, including the availability of leveraging funds and resources, will impact our ability to achieve expected outcomes.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

NHAES will evaluate the outcomes and impacts of these research activities by monitoring ongoing publication in peer-reviewed journals.

In addtion NHAES will monitor evidence for continued synergies between researchers and extension to disseminate up to date findings to stakeholders.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

2. Brief summary about Planned Program

Many aspects of climate, soils, landform and vegetation in New Hampshire and New England make it particularly susceptible to any changes in climate. We are near a northern temperature extreme for some forms of agricultural production. NH has the greatest proportion of forested land in the country. The vast majority of plant agriculture relies primarily on growing season rainfall rather than intensive irrigation. Our thin soils and shallow bedrock provide less buffer than many parts of the country. All of these make the ability to anticipate, mitigate, and adapt to potential changes in climate a priority. Further, as a heavily forested state, NH has the potential to serve as net carbon sink, which is important to the global environment.

This program addresses prediction, adaptation, and mitigation of climate change impacts on mixed agricultural, residential and forested landscapes. We have developed a more strongly focused and integrated effort on climate change research. Participants have strong productivity records and are internationally respected in their disciplines. Several of these individuals have not previously focused their work on agriculture, and their inclusion provides a powerful addition to our efforts, including substantial extramural funding to leverage NHAES support.

Our projects are integrated with Cooperative Extension, which is working with state and region stakeholders to plan landscape solutions for the Natural Resource Community.

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
101	Appraisal of Soil Resources			8%	
102	Soil, Plant, Water, Nutrient Relationships			30%	
112	Watershed Protection and Management			21%	
131	Alternative Uses of Land			25%	
133	Pollution Prevention and Mitigation			1%	
403	Waste Disposal, Recycling, and Reuse			9%	
511	New and Improved Non-Food Products and Processes			1%	
903	Communication, Education, and Information Delivery			5%	
	Total			100%	

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

1. Situation and priorities

New Hampshire and New England rely heavily on our natural and managed land base for economies based on production and tourism. Tourism, agriculture, and forestry comprise a very large portion of the NH economy, as well as for the other nearby states. Maintaining the health of these is critical to our quality of life and economic wellbeing.

There is overwhelming evidence that warming of the Earth's climate has been induced by the global footprint of human activities. Contributing factors include the rise of CO_2 in the atmosphere, increasing emissions of N_2O and other greenhouse gasses, and alteration of land surface properties through ecosystem management and land cover change. Changes in climate witnessed thus far have been as apparent in the Northeastern U.S. as elsewhere. Because natural and agricultural ecosystems are vital to the region's economic and cultural well-being, understanding the long-term effects of climate change is paramount. However, ecosystems also play an important role in climate regulation. Their influence occurs both as regulators of carbon dioxide and other greenhouse gases, as well as through their effect on surface albedo and other biophysical properties. Although climate change policy initiatives often include incentives for land management activities that can offset warming, most have focused on enhanced storage of carbon. This can be achieved through, for example, no-till agricultural practices or forest management practices that maximize standing biomass. Often not considered is the fact that these practices also bear climate consequences through other mechanisms (N_2O and CH_4 emissions, changes in reflected solar energy, etc.). Comprehensive studies of net climate impacts are rarely carried out, but are greatly needed for crafting effective land management policies that balance climate mitigation with food production, forest resources, and many other services for which these ecosystems are relied upon.

A second priority is achieving a better understanding of how microbial communities contribute to the formation and breakdown of soil organic matter (SOM). The timing and extent of SOM turnover is associated with N availability to support plant growth. Conventional agriculture uses inorganic N

inefficiently: typically 50% or more of inorganic fertilizer N is lost to the environment. Developing new strategies to build SOM will improve our ability to manage N in agricultural systems to maximize productivity and minimize N losses to ground water and to the atmosphere.

2. Scope of the Program

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

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

1. Assumptions made for the Program

Predicted changes in climate will have substantial implications for New England's natural and agricultural ecosystems. Changes in nutrient cycling and greenhouse gas production are likely to be equally important. Sufficient NHAES funding, and other resources, will continue to be available to undertake this multi-investigator integrated project.

2. Ultimate goal(s) of this Program

The goal of this program is to address climate change impact and mitigation issues by conducting a focused study of how agriculture and other land uses in a human-dominated landscape influence climate through a combination of carbon storage, greenhouse gas emissions (N_2O and CH_4), and alterations to reflection of solar radiation (shortwave albedo) and associated land surface heating. Results of this activity will highlight tradeoffs among multiple land management strategies in terms of their net climate effect. Information of this nature is of critical importance for preparing sound land management policies and designing strategies to cope with changes in climate.

We anticipate that outcomes from this program will provide knowledge and opportunities for NH stakeholders to anticipate and successfully adapt to changing climatic conditions. Additional impacts will be to improve N management in agricultural systems as part of ecosystems 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
2014	0.0	0.0	2.9	0.0
2015	0.0	0.0	2.9	0.0
2016	0.0	0.0	2.9	0.0
2017	0.0	0.0	2.9	0.0
2018	0.0	0.0	2.9	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Activity for the program includes:

• measuring C pools and greenhouse gas emissions (CO_2, CH_4, N_2O) in agricultural and suburban landscapes and comparing these data with data previously collected from forest plots in the same area
• using the combined data set to calibrate a high spectral resolution remote sensing image from NASA's AVIRIS instrument in the Durham, NH area
• using the field and remote sensing data to parameterize the denitrification decomposition (DNDC) computer simulation model, validate and upscale model predictions
• generating spatially continuous predictions of C pools, greenhouse gas emissions, and reflection of solar radition (shortwave albedo) to determine the net radiative forcing values (in W m^{-2}) for the major components of the landscape (mowed versus grazed pasture, corn fields, forest, and suburban lawns)
• making future projections of C, N and water balances for both agricultural and forested landscape units, using newly available CO_2 and climate change projections through 2100.
• Investigate the effects of different cropping systems, soil insects, and microbial community composition on Soil Organic Matter (SOM) turnover and soil nitrogen cycling.

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

Extension

Direct Methods	Indirect Methods
● Education Class ● Workshop ● Group Discussion ● One-on-One Intervention ● Demonstrations	● Web sites other than eXtension

3. Description of targeted audience

Target audiences include agricultural producers, and natural resource managers, and consumers, those involved in the related food products and marketing webs, land managers, scientists, public policy makers, and those who rely on agricultural and forest products currently and will in the future. Ultimately, all citizens in NH, New England, and the US have a strong stake in this topic and, therefore, the research outcomes.

V(G). Planned Program (Outputs)

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

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

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

V(H). State Defined Outputs

1. Output Measure

- Number of undergraduate students directly involved in the projects
- Number of graduate students directly involved in the project
- Number of university courses in which project results have been incorporated
- Number of presentations at regional, national, or international scientific meetings
- Number of workshops, training sessions and presentations to non-scientific stakeholders
- Number of websites in which project results have been incorporated
- Postdocs and other scientists taking who learn climate change research methods.

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

V(I). State Defined Outcome

O. No	Outcome Name
1	Number of graduate students trained to become the future generation of scientists.
2	Information relayed to non-scientific stakeholders through integrated research and extension partnerships.
3	Unbiased knowledge about tradeoffs among multiple land management strategies in terms of their net climate effect.
4	Understanding the impact of atmospheric deposition on water quality in order to develop management strategies that stakeholders can used to improve water quality.
5	Address microbial contributions to soil organic matter accumulation, and also to the timing and extent of soil organic matter (SOM) loss and N mineralization in various cropping systems

Outcome # 1

1. Outcome Target

Number of graduate students trained to become the future generation of scientists.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 112 - Watershed Protection and Management
- 131 - Alternative Uses of Land

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

Information relayed to non-scientific stakeholders through integrated research and extension partnerships.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 112 - Watershed Protection and Management
- 131 - Alternative Uses of Land

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Unbiased knowledge about tradeoffs among multiple land management strategies in terms of their net climate effect.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships

- 112 - Watershed Protection and Management
- 131 - Alternative Uses of Land

4. Associated Institute Type(s)

- 1862 Research

Outcome # 4

1. Outcome Target

Understanding the impact of atmospheric deposition on water quality in order to develop management strategies that stakeholders can used to improve water quality.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 112 - Watershed Protection and Management

4. Associated Institute Type(s)

- 1862 Research

Outcome # 5

1. Outcome Target

Address microbial contributions to soil organic matter accumulation, and also to the timing and extent of soil organic matter (SOM) loss and N mineralization in various cropping systems

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 112 - Watershed Protection and Management
- 131 - Alternative Uses of Land

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

The nature of this work means that weather extremes, natural disasters, and similar factors would substantially disrupt or interfere with field aspects of research. Climate change is currently a public and governmental priority. Any changes in this situation, including availability of leveraging funds and resources, remote sensing products, or similar changes would affect the outcomes.The current Federal and State budgetary limitations, combined with previous reductions (FY12-13) in NHAES capacity funds, will impact support of research, personnel, or facilities and result in a negative impact on our abilities to complete expected outcomes. Competing programmatic challenges must be considered in prioritizing resource use.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Progress in this planned program area will be evaluated

• through review by peer scientists, feedback from all manner of information stakeholders, and success in leveraging NHAES resources with competitive grant funds.

• adoption of refined models of climate change impacts on different landscapes by end users: farmers, natural resources managers, government planners.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Food Safety

2. Brief summary about Planned Program

The safety of agricultural and aquacultural food products is of high concern to all consumers within NH, and therefore within the umbrella of NHAES research. Supported research will target improving the safety and reliability of food products grown, harvested, or produced and consumed locally, regionally, and nationally.

Current thrusts will combine discovery and applied research to:

- define commonalities and differences in the mechanisms of biofilm adaptation between pathogens and commensals of agriculturally important hosts, and, importantly, to understand the mechanisms behind these and related processes to aid the management of agricultural production in the future;
- address the emergent problem of pathogenic Vibrios in shellfish in the Northeast;
- understand and ameliorate the pathways through which domestic animals and humans become exposed to toxic microcystins produced by cyanobacterial blooms in freshwater lakes and drinking water reservoirs.

In particular, the last two activities combine research, extension, and teaching in an effective integrated effort.

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 : No

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
133	Pollution Prevention and Mitigation			4%	
135	Aquatic and Terrestrial Wildlife			21%	
212	Pathogens and Nematodes Affecting Plants			8%	
215	Biological Control of Pests Affecting Plants			7%	
311	Animal Diseases			10%	
501	New and Improved Food Processing Technologies			13%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			25%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			12%	
	Total			100%	

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

1. Situation and priorities

• Microbial growth, as biofilms, represents the predominant microbial life style on the planet, yet little is understood about the ecology and physiology of biofilms. Gaining a greater understanding about the mechanisms behind biofilm adaptation, between pathogens and their hosts or probiotic bacteria and their hosts, as well as a better understanding of biofilm ecology and physiology is a high priority for agricultural applications.

• Pathogenic Vibrio species cause shellfish-borne disease in the U.S. and worldwide. Previously limited to occasional outbreaks in shellfish from subtropical waters, this has become an emergent problem as ocean temperatures increase in temperate regions. Outbreaks of gastrointestinal illness caused by Vibrio parahaemolyticus and Vibrio vulnificus infections are a growing concerns for consumers of shellfish. An additional complication is that both Vibrio species have benign and virulent (disease causing) strains and current survey methods do not readily distinguish between the forms. The shellfish aquaculture industry has suffered increasingly with more frequent vibrio-associated disease outbreaks linked to shellfish consumption, both on a regional and a national scale. These outbreaks and individual cases of disease have had a widespread and cumulatively devastating impact on markets. Because of this, a top priority of the east coast shellfish growers industry is to reduce food-borne illnesses associated with their products.

• Microcystins are cyclized chains of amino acids produced by cyanobacterial blooms in recreational and drinking water bodies. Evidence, which links microcystins to neurodegenerative diseases in animals and humans, is accumulating. Understanding the pathways by which microcystins spread through the environment is paramount to ameliorating the ways in which the toxins come into contact with humans through agricultural animals, fruits, and vegetables. Controlling environmental exposure to microcystins is an important aspect of food safety in the region and across the U.S.

2. Scope of the Program

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

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

1. Assumptions made for the Program

• Forming biofilms is an essential component of how free-living Pseudomonas species interact with host organisms (e.g., plants, animals) in relationships that are either commensal or pathogenic. These interactions are of broad interest to agricultural communities.

• Vibrio diseases are an emerging problem for shellfish harvesting and processing, and need to be managed in order to ensure safety for consumers and economic viability for the shellfish aquaculture industry in New England and the rest of the world. The incidence of virulent strains in populations of otherwise benign bacterial species within microbial ecosystems also poses a threat for severe wound infections in people who swim, fish, and work in coastal waters.
• The increased incidence of Vibrio diseases associated with shellfish consumption in north temperate coastal areas of the U.S. is emerging as a significant concern. Simple models can be constructed to help in the risk analysis needed to manage shellfish harvesting in the Northeast U.S. The results from this work will help to refine and inform monitoring strategies for these pathogens in colder north temperate coastal waters in relation to emerging U.S. FDA guidelines.
• Cyanobacterial blooms that produce toxic microcystins will continue in the state and region,
• Overall assumption: Funding and resources will continue to be available at the same, or increased, level to enable conduct of research and engagement activities,

2. Ultimate goal(s) of this Program

• A primary goal is to increase our understanding of bacterial biofilms and how these may be managed to enhance crop productivity and/or to minimize disease.
• A second goal of the research covered in this program is to help elucidate environmental and biological conditions and pathways that are useful for reducing or avoiding exposure to elevated levels of pathogenic Vibrio species.
• Ongoing studies examining the accumulation of microcystins in freshwater lakes have led to the improved monitoring and management of blooms. A new concern is to determine whether the toxins accumulate in watershed soils, vegetation surrounding lakes, or on garden fruits and vegetables that are irrigated with contaminated waters. These are all potential modes of animal and human exposure to microcystins.

V(E). Planned Program (Inputs)

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

Year	Extension		Research	
	1862	1890	1862	1890
2014	0.0	0.0	1.5	0.0

Year	Extension		Research	
	1862	1890	1862	1890
2015	0.0	0.0	1.5	0.0
2016	0.0	0.0	1.5	0.0
2017	0.0	0.0	1.5	0.0
2018	0.0	0.0	1.5	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Several different research projects are conducted under this program, and activities include:

• using experimental evolution to identify the suites of adaptations that occur as Pseudomonas sp. to form symbiotic or pathogenic biofilms;
• developing, refining, and applying methods for the detection and enumeration of Vibrio parahaemolyticus and Vibrio vulnificus;
• developing new methods to distinguish between benign and virulent strains of Vibrio parahaemolyticus and Vibrio vulnificus;
• evaluating, through a variety of means, how microcystins are spread across landscapes to animal and human food sources;
• disseminating research outcomes via scientific, extension, formal and informal venues, and to stakeholder groups and natural resource managers.

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

Extension

Direct Methods	Indirect Methods
● Education Class ● Workshop ● Group Discussion ● One-on-One Intervention ● Demonstrations	● Web sites other than eXtension

3. Description of targeted audience

The target audiences for these research activities include both discrete and overlapping audiences.

• For bacterial biofilms, the audience targeted is peer researchers, students, and ultimately agricultural producers concerned with the role of Pseudomonas in crop or animal productivity and disease.
• For Vibrio pathogens in shellfish, the target audience is the shellfish industry and shellfish regulatory agencies, graduate and undergraduate students, high school students, faculty collaborators, and other scientists.
• For microcystins from cyanobacterial bloom, the target audience is students (college and pre-college), scientists, lake shore residents, lake association members, local and regional decision makers, source

water protection and watershed managers, surface drinking water suppliers, and public health and environmental agencies.

V(G). Planned Program (Outputs)

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

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

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

V(H). State Defined Outputs

1. Output Measure

- Number of undergraduate students directly involved in the projects
- Number of university courses in which project results have been incorporated
- Number of presentations at regional, national, or international scientific meetings
- Number of workshops, training sessions, and presentations to non-scientific and regulatory stakeholders
- Number of graduate students directly involved in the research.
- Number of reviewed, bulletin, popular and other publications
- Number of websites in which project results have been incorporated
- Number of surveys or other means of gathering information and data from participants
- Postdoc and other scientists trained in cutting edge research methods

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

V(I). State Defined Outcome

O. No	Outcome Name
1	Increased knowledge about the incidence and detection of vibrio in oysters.
2	Knowledge of environmental and biological factors associated with reduced concentrations of vibrios in harvested and processed oysters.
3	Number of agencies and stakeholder groups involved in research outreach related to vibrios in shellfish.
4	Increased knowledge about mechanisms of biofilm adaptation and diversification in pathogens and symbionts.
5	Knowledge about the changes in Vibrio genomes, which cause transitions to virulence;
6	Understanding of how microcystin toxins spread from lakes to the terrestrial food chain

Outcome # 1

1. Outcome Target

Increased knowledge about the incidence and detection of vibrio in oysters.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

Knowledge of environmental and biological factors associated with reduced concentrations of vibrios in harvested and processed oysters.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Number of agencies and stakeholder groups involved in research outreach related to vibrios in shellfish.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally

Occurring Toxins

4. Associated Institute Type(s)

- 1862 Research

Outcome # 4

1. Outcome Target

Increased knowledge about mechanisms of biofilm adaptation and diversification in pathogens and symbionts.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 212 - Pathogens and Nematodes Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 311 - Animal Diseases

4. Associated Institute Type(s)

- 1862 Research

Outcome # 5

1. Outcome Target

Knowledge about the changes in Vibrio genomes, which cause transitions to virulence;

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 311 - Animal Diseases
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

4. Associated Institute Type(s)

- 1862 Research

Outcome # 6

1. Outcome Target

Understanding of how microcystin toxins spread from lakes to the terrestrial food chain

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 135 - Aquatic and Terrestrial Wildlife

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

Natural disasters or weather extremes affecting coastal areas could impact the accurate evaluation of environmental factors that influence the incidence and detection of Vibrios in oysters. Extremely heavy rains or drought conditions will impact the frequency of cyanobacterial blooms in fresh water lakes.

Changes in funding and resource availability for the activities, and in policies or regulations related to research using animal and human subjects, would compromise the feasibility of completing the objectives. The current Federal and State budgetary limitations, combined with previous reductions in NHAES capacity funds, will impact funding of research, personnel, or facilities, impairing our abilities to complete the proposed research.

Competing programmatic challenges must be considered in prioritizing resource use. Any changes in this situation, including the availability of leveraging funds and resources, or similar changes, would affect the outcomes.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

We will:

- monitor the progress of researchers' projects, as gauged by acceptance of manuscripts in peer-reviewed journals, and the ability of these researchers to leverage NHAES funds for external grants;
- quantify adoption of new risk-management strategies by stakeholders (commercial shellfish operations, watershed associations);
- monitor evidence for continued synergies between researchers and extension to disseminate up to date findings to stakeholders.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Global Food Security and Hunger

2. Brief summary about Planned Program

Plant and animal agriculture are integral components of the past, present, and future New Hampshire and New England landscapes. New approaches to farming must be evaluated within the regional constraints: soil quality, growing season, and reliance on rainfall rather than irrigation. NHAES is conducting research to develop and evaluate alternative feeding strategies to increase the economic sustainability of organic and conventional dairy farms in the Northeast. Targets include improving supplementation strategies for pasture-fed organic dairy operations, enhancing the quality and nutrient utilization of pasture forage, and providing farmer tools to evaluate profitability and risk. Other studies involve developing treatments to improve fertility of dairy cattle that are artificially inseminated with conventional or sexed semen. Discovery research aims to improve an understanding reproductive physiology in ruminants in order to reduce infertility. Furthermore, while dairy has long dominated animal agriculture in NH, there is renewed activity in locally-produced poultry, beef, and regional sources of animal feed. Research on effective biologically-based weed management strategies will reduce the need for mechanical and physical weed control and improve agricultural sustainability including organic production.

The second primary area of NH food production is in vegetables and small fruits. NHAES master plant breeder J. Brent Loy uses conventional breeding approaches to develop squash, melon, gourd, and pumpkin varieties with improved taste, nutrition, appearance, disease resistance, and suitability for regional climate conditions. A related effort will develop interspecies hybrids of squash with improved carotenoid content, taste, and handling characteristics for processing and fresh markets. Through the use of genomic tools, another NHAEAS geneticist is beginning to apply marker-aided selection to breed improved varieties of octoploid strawberry. Other research projects will evaluate the characteristics and adaptation of vegetable and fruit varieties to Northern New England, and develop and evaluate management techniques to decrease fungal pathogens, extend the growing season, increase profitability, reduce environmental impact, and improve the efficiency of vegetable and fruit cropping systems in NH.

Several projects study plant pathogens and pests: Nematodes cause substantial damage to agricultural production worldwide. One NHAES project will study synthetic inhibitors of cyclic nucleotide phosphodiesterases (PDEs), which may be useful as targeted nematicides. Another will develop genetic and molecular tools to investigate the mechanisms of fungal rust resistance in barberries, an alternative host of wheat stem rust.

Another aspect of this planned program area involves supporting the growing and regionally important aquaculture industry. A project involving four scientists and an extension specialist will develop integrated multi-trophic aquaculture methods for land-based and near-shore systems. Genetic variation in the red alga Porphyra umbilicalis will be exploited to improve nutrient scrubbing in recirculating finfish aquaculture. Another project will focus on generating triploid green sea urchins that would provide higher consumer preference uni and therefore greater dollar value for local producers.

Some research will be more fundamental in nature, leading to future improvements in agriculture and aquaculture. These projects include efforts to:

- identify key reproductive hypothalamic and pituitary hormones, which are important to help control

reproduction in aquaculture of commercially-important finfish;

- increase understanding of the symbiosis between beneficial Frankia microbes and actinorhizal plants are important in land reclamation and for fuel and animal fodder in the developing world.
- improve understanding of translational control of mRNA of gene expression in the model plant Arabidopsis which is essential for plants in responding to rapid changes in their environment.

Integrated research and extension efforts in this area are maintained through partial support for extension faculty, and by developing effective synergies with national colleagues that are facilitated through an affiliation with five multistate research and extension projects. In the global food security and hunger planned program, eight NHAES scientists participate in the following multistate projects: NE009 - Conservation and Utilization of Plant Genetic Resources, NE1047 - Ecological Bases for Weed Management in Sustainable Cropping Systems, S1053- Ecological and genetic diversity of soilborne pathogens and indigenous microflora, NE1034 (temp) - Genetic Bases for Resistance and Immunity to Avian Diseases, and NC 1042 (temp) - Management Systems to Improve the Economic and Environmental Sustainability of Dairy Enterprises.

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
135	Aquatic and Terrestrial Wildlife			1%	
201	Plant Genome, Genetics, and Genetic Mechanisms			2%	
202	Plant Genetic Resources			7%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			6%	
204	Plant Product Quality and Utility (Preharvest)			13%	
205	Plant Management Systems			4%	
206	Basic Plant Biology			2%	
212	Pathogens and Nematodes Affecting Plants			10%	
216	Integrated Pest Management Systems			2%	
301	Reproductive Performance of Animals			20%	
302	Nutrient Utilization in Animals			4%	
303	Genetic Improvement of Animals			2%	
305	Animal Physiological Processes			4%	
307	Animal Management Systems			10%	
311	Animal Diseases			4%	
601	Economics of Agricultural Production and Farm Management			2%	
701	Nutrient Composition of Food			2%	
903	Communication, Education, and Information Delivery			5%	
	Total			100%	

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

1. Situation and priorities

The largest segments of New Hampshire's agricultural sector, excluding ornamental horticulture, are dairy, vegetable and fruit production, and aquaculture. As a result, this planned program comprises our largest effort. New Hampshire residents share the goal of having a thriving small-scale agrarian sector, along with a clean and healthy environment. Each brings important individual benefits and, combined, they greatly support our critical tourism and related service industries.

The NHAES commitment to the dairy industry is evident through our support of two operational research and teaching dairies - one a conventional Holstein operation based on total mixed ration feeding and the second an organic dairy-based agroecosystem using pasture-fed Jersey cows. We have recently added a cohort of Jerseys to the conventional dairy to allow direct comparisons of organically and conventionally managed cows and products. Similarly, we support two horticultural/agronomy farms and a greenhouse complex for vegetable and fruit breeding, genetics, and production. A portion of one horticultural farm is in transition to organic certification to enable us to address issues of importance to that agricultural segment. The NHAES is developing a multi-trophic teaching and research farm facility, close to campus, to expand the opportunities for experiential learning in the sustainable agriculture and food systems major.

New England in general, and New Hampshire in particular, produces less than 10% of the food calories it consumes. The state and region, therefore, is particularly dependent on imported food, mostly from distant locations across the United States and from many other countries. The continued supply of that food, over 60% of which is imported from overseas, is insecure based on the highly volatile supply and price of oil. However, the balance between imported and locally produced food is beginning to change. NH is number 3 in the ranking of U.S. agriculture direct market sales; New England states now represent the top seven states in direct market sales (National Agricultural Statistics Service).

Globally, the demand for seafood continues to rise while many wild fish stocks are at or beyond sustainable harvest levels. Export of green sea urchins from the Gulf of Maine to Japan is one example of a robust fishery that collapsed through overfishing over previous decades. To meet rising consumer demand, much of the production will depend on continued growth in the aquaculture industry. The growth of aquaculture is, however, meeting resistance in many areas due to associated water quality problems and the reliance on fish meal-based diets derived from wild harvested fish. Integrated multi-trophic aquaculture, in which multiple species are grown in concert, may alleviate some of these problems: seaweeds would remediate wastes from finfish, baitworms or sea urchins. Oysters also remove small particulates in estuarine aquaculture. Seaweeds can be used as supplemental feeds for urchins and finfish. Improvements in sea urchin aquaculture are needed to replace natural stocks in order to reinvigorate this valuable export product.

America's abundant and inexpensive supply of food and fiber is based on a productive and progressive agricultural system. The foundation for this productivity has been based on scientific knowledge and the exploitation of useful genetic diversity for developing new, higher quality cultivars that can resist pests, diseases, and environmental stresses. The genes that are needed to provide a continued flow of new varieties, which produce higher yields with better quality and improve resistance to pests, diseases, and abiotic stresses, can only come from diverse plant germplasm. Most of the food crops, important to the American diet, have their origin in other parts of the world and the genetic diversity of these plant species evolved in their centers of origin, and not in Northern New England. Genetic diversity continues to be essential for plant breeders and other scientists as they breed new varieties that are important to American consumers today. Locally adapted crop varieties are needed to serve consumer demands for high quality, locally grown produce and value-added horticultural products. A short growing season, high labor costs and high land values make fruit and vegetable production far more costly in New England than elsewhere. Further, an extremely variable and humid climate make disease and insect pests a constant threat to the profitability of NH farms. To compete with west coast and international agricultural producers, NH vegetable and fruit growers must produce unique and high-value products. To attain sustainability, NH fruit and vegetable growers must reduce use of chemical pesticides, minimize crop production costs, maintain high crop quality and yields, and have reliable and consistent markets for their products. There are many production challenges unique to NH and New England conditions. Regionally-focused agricultural research is needed to identify crops, crop varieties, and production practices that are best suited to these conditions.

Impaired reproductive performance is a major cause of reduced productivity for ruminants and reduced profitability for dairy and meat animal producers. In the U.S., over 4 million replacement dairy heifers are raised annually. The cost of raising dairy replacements represents 15% to 25% of the total cost of managing a dairy operation. There is increasing interest in organic dairy production in response to higher milk prices and perceived consumer demand. Purchased feeds, including forage and grains, account for an average of 36% of the total cash expenses of organic dairy farms located in northern New England. Northeast producers cited the high costs of production as one of the most challenging aspects of sustaining organic dairying in the region.

2. Scope of the Program

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

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

1. Assumptions made for the Program

Most national research on production methods is applicable to terrain and climates that are very different from those faced by NH growers. Crop varieties that are developed elsewhere may or may not be adapted to the short growing season, cold winter temperatures, specific soil types, or prevalent pests of NH. As a result, varieties must be carefully evaluated for performance in this region. The attractiveness of local produce to consumers can be enhanced by developing new varieties with improved appearance, eating quality, and nutrition. In addition, improved disease resistance in fruit and vegetable crops reduces pesticide inputs and increases profitability.

We are entering an uncertain economic period and cannot continue to rely on past cheap oil supplies, both because of the depletion of remaining inexpensive oil stocks and greater competition for those stocks, and because of uncertain global economic conditions. Alternative feeding strategies and supplements will improve milk quality and yield, and reduce feed costs and outputs of N to ground water (eutrophication) and methane (CH_4, greenhouse gas) to the environment. Seasonal changes in fluid milk color and flavor, along with differences in omega 3/omega 6 fatty acid ratios between grass-fed and total mixed ration-fed dairy cows, will impact potential uses of fluid milk and value-added dairy products, including consumer preference.

By integrating production of commercially important seaweeds and oysters that can utilize the waste products of other cultured species (e.g. fish, sea urchins) the total economic potential of aquaculture is increased, while environmental impacts are minimized.

Support dollars for NHAES will increase or remain the same, as will staffing levels, research space and other resources required to complete the work.

2. Ultimate goal(s) of this Program

- To increase our understanding of and abilities to produce agricultural food products.

• To address state, regional and international food security consistent with maintaining environmental quality.
• To contribute to the abilities of New Hampshire and regional stakeholders to maintain viable agricultural businesses and careers.
• To advance scientific knowledge in related areas.

V(E). Planned Program (Inputs)

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

Year	Extension		Research	
	1862	1890	1862	1890
2014	0.0	0.0	11.0	0.0
2015	0.0	0.0	11.0	0.0
2016	0.0	0.0	11.0	0.0
2017	0.0	0.0	11.0	0.0
2018	0.0	0.0	11.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Conduct applied and discovery research and undertake engagement with stakeholders in multiple aspects of plant and animal agriculture, related genetics and genomics, nutrition, and integrated aquaculture, involving shellfish, finfish, invertebrates, and seaweed.

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

Extension

Direct Methods	Indirect Methods
● Education Class ● Workshop ● Group Discussion ● Demonstrations ● Other 1 (Research Field Days) ● Other 2 (field and laboratory research)	● Newsletters ● eXtension web sites ● Web sites other than eXtension

3. Description of targeted audience

The target audience of this work includes consumers of animal and plant based foods and products, organic and conventional farmers, aquaculture ventures, restaurants and other businesses reliant on local foods, master gardeners, home gardener associations, consumers and legislators, and those engaged in the extensive food systems network. It also includes scientists, veterinarians, agricultural researchers, Cooperative Extension specialists, agricultural teachers, graduate and undergraduate students, and the

faculty and staff of the region's land grant universities.

V(G). Planned Program (Outputs)

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

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

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

V(H). State Defined Outputs

1. Output Measure

- Number of undergraduate students directly involved in the projects
- Number of graduate students directly involved in the research
- Number of university courses in which project results have been incorporated
- Number of presentations at regional, national, or international scientific meetings
- Number of workshops, training sessions and presentations to non-scientific stakeholders
- Number of reviewed, bulletin, popular and other publications
- Number of websites in which project results have been incorporated
- Number of surveys or other means of gathering information and data from participants
- Number of postdocs and other scientists trained in cutting edge research methods

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

V(I). State Defined Outcome

O. No	Outcome Name
1	Increased knowledge about plant varieties and production practices suited to the state and region.
2	New knowledge about dairy production, nutrition, animal health and dairy products important to regional producers.
3	Advances in squash varieties having enhanced eating properties and nutritional benefits including carotenoid concentrations.
4	Increased knowledge about integrated multitrophic aquaculture systems.
5	New genomic knowledge translated into tools and strategies to facilitate varietal selection through marker assisted breeding.
6	New commercialized varieties of cucurbit vegetables suited to state and region growing conditions.
7	Improved range of weed management options available for sustainable and organic growers.
8	A working technology to produce triploid green sea urchins for use in natural harvest and land based aquaculture.
9	Improvement in finfish aquaculture in recirculating production systems
10	Develop regionally appropriate management systems to suppress soil borne pathogens for both organic and conventional farms.
11	Knowledge related to how the neuroendocrine system influences reproduction in fin fish aquaculture and other vertebrate animals and in the control of pest species such as lamprey eels.
12	Produce new genetic and molecular tools to investigate the mechanisms of fungal rust resistance in barberries, an alternative host of wheat stem rust

Outcome # 1

1. Outcome Target

Increased knowledge about plant varieties and production practices suited to the state and region.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

New knowledge about dairy production, nutrition, animal health and dairy products important to regional producers.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 307 - Animal Management Systems
- 311 - Animal Diseases
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Advances in squash varieties having enhanced eating properties and nutritional benefits including carotenoid concentrations.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 4

1. Outcome Target

Increased knowledge about integrated multitrophic aquaculture systems.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 204 - Plant Product Quality and Utility (Preharvest)
- 302 - Nutrient Utilization in Animals
- 307 - Animal Management Systems
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Research

Outcome # 5

1. Outcome Target

New genomic knowledge translated into tools and strategies to facilitate varietal selection through marker assisted breeding.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 204 - Plant Product Quality and Utility (Preharvest)

4. Associated Institute Type(s)

- 1862 Research

Outcome # 6

1. Outcome Target

New commercialized varieties of cucurbit vegetables suited to state and region growing conditions.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 204 - Plant Product Quality and Utility (Preharvest)

4. Associated Institute Type(s)

- 1862 Research

Outcome # 7

1. Outcome Target

Improved range of weed management options available for sustainable and organic growers.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 8

1. Outcome Target

A working technology to produce triploid green sea urchins for use in natural harvest and land based aquaculture.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 9

1. Outcome Target

Improvement in finfish aquaculture in recirculating production systems

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 135 - Aquatic and Terrestrial Wildlife
- 305 - Animal Physiological Processes
- 307 - Animal Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 10

1. Outcome Target

Develop regionally appropriate management systems to suppress soil borne pathogens for both organic and conventional farms.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 212 - Pathogens and Nematodes Affecting Plants
- 216 - Integrated Pest Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 11

1. Outcome Target

Knowledge related to how the neuroendocrine system influences reproduction in fin fish aquaculture and other vertebrate animals and in the control of pest species such as lamprey eels.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 305 - Animal Physiological Processes
- 307 - Animal Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 12

1. Outcome Target

Produce new genetic and molecular tools to investigate the mechanisms of fungal rust resistance in barberries, an alternative host of wheat stem rust

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

Weather and climate extremes and natural disasters affect the outcomes of field research on plants and animals. Economic factors and government regulations may impact the available resources and abilities of relevance in undertaking specific research methods. The current Federal and State budget limits, combined with previous reductions in NHAES State capacity funds, will impact the funding of this research, personnel, or facilities and impair on our abilities to complete the projects. Competing programmatic challenges must be weighed to ensure the effective use of limited NHAES resources.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

• Monitoring the progress of projects, as gauged by the acceptance of manuscripts in peer reviewed journals and the ability of these researchers to leverage NHAES funds for external grants.
• Stakeholder surveys conducted during outreach activities indicating the levels of interest and the impact of research outcomes on stakeholder planning activities.
• Evidence of adoption of new plant varieties and production methods.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Supporting Rural Economies

2. Brief summary about Planned Program

New Hampshire is a strongly rural state within the similarly rural region of Northern New England. We enjoy a rather unique circumstance of having proximity to rural and urban areas, through population centers in the southern part of the state (Concord, Manchester, Nashua) and our Southern New England neighbors in MA. As an example, Boston is 65 miles from the University of New Hampshire.

A perception that decisions impacting agriculture and natural resources in rural areas are arrived at through appropriate stakeholder participation is important to public acceptance. One project will design, apply, and evaluate approaches to facilitate two-way communication between managers, policy makers, and stakeholders and evaluate the utility and value of web-based instruments in this process.

Solid waste management continues to be a problem for local governments in the rural U.S. One project will examine key issues in local governments' provisions of recycling and solid waste management services, including options of privatization.

The NHAES research programs in this area address this situation by focusing on the welfare of low-income individuals and families in rural areas and how changes in demographics will impact land use and need for public spending.

Ornamental and landscape horticulture represents the single largest agricultural economic sector in NH, and is closely tied to the economies of our rural areas. We offer strong support through funded projects as well as provide the farm and greenhouse facilities that are used for research, extension, and teaching. Research in this program area includes developing sustainable plant nutrition management strategies for bedding and potted flowering plants, and developing new procedures to maintain root systems over the winter in northern nursery production systems. The latter will allow northern nurseries to grow stock locally, rather than transport trees and shrubs from southern growers. This will reduce production costs for northern nurseries while allowing them to expand local operations.

NHAES' efforts in the supporting of rural economies involve the integrated research and extension efforts of two extension faculty with split appointments. Another faculty is participating in multistate research projects, W3001 - Population dynamics and change: Aging, ethnicity , and land use change in rural communities. Another research will participate in NE1049, Community Health and Resilience which concentrates on agriculture, the rural work force, and water and environmental issues. Finally one NHAES researcher is part of WERA1010, seeking to reduce sources of error in rural and agricultural surveys.

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
102	Soil, Plant, Water, Nutrient Relationships			27%	
133	Pollution Prevention and Mitigation			13%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			15%	
605	Natural Resource and Environmental Economics			5%	
608	Community Resource Planning and Development			20%	
901	Program and Project Design, and Statistics			10%	
903	Communication, Education, and Information Delivery			10%	
	Total			100%	

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

1. Situation and priorities

The New Hampshire agricultural, forestry, and natural resources based economies -and much of our substantial tourist industry - are fundamentally based on the state's rural character. It is a compelling quality of life factor to state residents and highly attractive to visitors. Maintaining this important aspect of our state requires that our rural citizens and communities are able to thrive both socially and economically. While the NHAES cannot address all of the salient issues related to rural communities and economies, we do and will continue to contribute a substantial component of important knowledge that is critical to rural citizens, local and state organizations, and federal agencies with relevant oversight. Our role in providing unbiased and objective information is particularly critical in helping to resolve sometimes emotionally and politically charged topics.

Ornamenal horticulture is the number one agriculture sector in NH. The production component of this sector takes place in rural areas and is an important source of employment. NHAES funds research on potted flowering plants, and new production systems for shrubs and trees, to address the needs of rural producers and help them to become more competitive.

Rural residents are often underemployed or unemployed due to personal choice reasons or reasons beyond their control. The aging of the U.S. population affects rural areas in unique and geographically diverse ways, with increasing rates of retirement migration affecting some areas and aging-in-place occurring elsewhere. The changing racial and ethnic composition of rural areas produces social and economic challenges to the integration of these new racial and ethnic groups. Rapid population growth along the urban-rural periphery and in high amenity areas requires a careful examination of land use

patterns.

2. Scope of the Program

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

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

1. Assumptions made for the Program

Without knowledge of regional differences, policy formation within New Hampshire may be misdirected and the state would be excluded from project efforts to disseminate findings that enhance the response capabilities of local government officials, regional economic development officers, extension personnel, and other stakeholders. Ongoing efforts are needed to assist municipal, county, state and regional planners to engage stateholders and to design policy changes to improve the welfare of the community. New knowledge about economically, environmentally, and socially sustainable production practices in floriculture and landscape horticulture will continue to be key to employment in these large sectors of our rural economy.

2. Ultimate goal(s) of this Program

The ultimate goal of this program area is to provide new knowledge, practices and conditions in support of a thriving rural economy and social policy structure in New Hampshire and New England.

V(E). Planned Program (Inputs)

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

Year	Extension		Research	
	1862	1890	1862	1890
2014	0.0	0.0	1.9	0.0
2015	0.0	0.0	1.9	0.0
2016	0.0	0.0	1.9	0.0
2017	0.0	0.0	1.9	0.0
2018	0.0	0.0	1.9	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

• Investigate the changing organizational structure, tax policy and fiscal standing of local governments and the impact of tax and/or expenditure limitations on local government fiscal stress and economic growth in rural areas.

• Develop a better understanding of the role of amenities in rural development and the impact of economic and social changes on the quality of life in rural communities.

• Examine the aging of the rural population within the context of overall U.S. population aging, and describe how in-migration, aging-in-place, and other demographic forces shape the spatial distribution and composition of rural populations.

• Develop improved over-wintering techniques for large container grown trees and shrubs to save labor and enhance profitability for northeastern producers. Assuming a continuation of high-energy costs, there will be renewed interest in the local production of agricultural products once economic recovery results in increased demand for landscape plant material.

• Undertake greenhouse trials to determine effective and resource-efficient management techniques for the use of controlled-release fertilizers in producing bedding and potted bedding plants of importance to the state and region.

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

Extension

Direct Methods	Indirect Methods
● Education Class ● Workshop ● Group Discussion ● One-on-One Intervention ● Demonstrations ● Other 1 (Field and Laboratory research)	● Newsletters ● Web sites other than eXtension

3. Description of targeted audience

• Scientists, undergraduate and graduate students, citizens, land use professionals, homeowners, legislators, contractors, firms and rural residents, demographers, social and natural scientists as well as policy-makers and the media.

• State policy makers, planners and concerned citizens that will 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.

• Owners and operators of greenhouses that produce floriculture crops.

• Nursery producers and landscape contractors in NH and throughout the northeast.

• Extension educators who work in horticulture.

• State citizens interested in efficient and sustainable use of the state's economic and environmental resources in support of a thriving social structure.

V(G). Planned Program (Outputs)

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

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

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

V(H). State Defined Outputs

1. Output Measure

- Number of presentations at regional, national, or international scientific meetings
- Number of workshops, training sessions and presentations to non-scientific stakeholders
- Number of reviewed, bulletin, popular, news and other publications
- Number of surveys or other means of gathering information and data from participants
- Number of graduate students directly involved in research project.
- Number of websites in which project results have been incorporated
- Number of undergraduate students directly involved in the projects

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

V(I). State Defined Outcome

O. No	Outcome Name
1	Number of presentations to civic and government entities to increase knowledge of demographics and migration in the region and nation.
2	Availability of modified production systems for woody nursery crops in northern nurseries.
3	Availability of new management guidelines for use of controlled-release fertilizers in greenhouse floriculture.
4	Improved methods to facilitate two-way communications between public and decision makers, and survey instruments associated with natural resource and agriculture management

Outcome # 1

1. Outcome Target

Number of presentations to civic and government entities to increase knowledge of demographics and migration in the region and nation.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 901 - Program and Project Design, and Statistics
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

Availability of modified production systems for woody nursery crops in northern nurseries.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Availability of new management guidelines for use of controlled-release fertilizers in greenhouse floriculture.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships

4. Associated Institute Type(s)

- 1862 Research

Outcome # 4

1. Outcome Target

Improved methods to facilitate two-way communications between public and decision makers, and survey instruments associated with natural resource and agriculture management

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development
- 901 - Program and Project Design, and Statistics
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

Economic and public policy changes affect rural economies and choices related to lifestyle and social services. Natural disasters are another factor that can have unanticipated and often localized influences on rural populations. Population changes through migration, immigration, cultural groupings, and other factors are the target of one research project. Reduction in NHAES resources available to support this work will compromise its effectiveness and completion. Research emphases must always be evaluated relative to competing programmatic challenges and opportunities in order to provide greatest value to society.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

The NHAES will monitor the outcomes and impacts in this program area in the following ways:

- publication of scholarly studies in peer reviewed journals
- utilization of demographic analysis by local, state and regional planners and policy makers. (citations in public media, by policy makers, etc.)
- adoption of plant growth recommendations by commerical floriculture industry (web site hits, requests for literature at workshops and via Cooperative Extension)
- adoption by nursery growers of new production methods for overwintering landscaping shrubs and trees (web site hits, requests for literature at workshops and via Cooperative Extension web sites).