

# 2015 University of New Hampshire Combined Research and Extension Plan of Work

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## I. Plan Overview

### 1. Brief Summary about Plan Of Work

New Hampshire has a total population of 1.3 million people. Agriculture and associated natural resources are core contributors to the NH economy in a state that is 84% forested. While most of NH has a decided rural character, small cities (30,000-110,000) are concentrated in the southern tier of the state. The attractive open spaces maintained by pastoral small-scale agricultural operations combine with NH's abundant natural resource base to create a compelling venue in support of a large tourism sector.

The University of New Hampshire serves the state as the principle land-grant university, charged by Congress to conduct resident instruction, research, and outreach to people beyond the formal classroom.

The New Hampshire Agricultural Experiment Station (NHAES) resides within the University of New Hampshire's (UNH) College of Life Sciences and Agriculture (COLSA). The NHAES is responsible for the funding of Hatch and Hatch-Multistate agricultural research and McIntire-Stennis cooperative forestry research programs. The Plan of Work covers the NHAES's federal and state partnership-funded Hatch and Hatch-Multistate research components.

The NHAES focuses 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 opportunities for training the next generation of agricultural scientists and educated citizen consumers.

The University of New Hampshire Cooperative Extension (UNHCE) provides New Hampshire residents with research-based information, enhancing their ability to make informed decisions that strengthen youth, families, and communities; sustain natural resources; and improve the economy. As part of a University outreach program, the network of professional Extension staff resides in all ten New Hampshire counties. County staff works with local volunteers and specialists on the UNH campus to design and conduct educational programs that meet societal, environmental, and economic needs. While many of our programs are conducted locally, we also use current communication technologies including computer networking, the Internet (including eXtension), and interactive video conferencing. As part of the national land-grant university system, we access the knowledge and expertise of other state land-grant universities throughout the United States.

NHAES research strongly supports the agricultural and natural resource enterprises through our suite of funded projects and through Cooperative Extension trials and outreach conducted on NHAES's two horticultural/agronomy farms, two dairies, and research greenhouses. Research at the farms and dairies address both conventional and organic research and management needs; which are disseminated to our varied stakeholders. Located in close proximity to the Gulf of Maine, UNH provides an opportunity to support coastal marine aquaculture through research and meaningful engagement with producers,

harvesters, and other stakeholders.

The planned programs discussed in this Plan of Work are inclusive of the USDA-NIFA priority programs in (childhood) obesity, climate change and sustaining natural resources, food safety, and global food security & hunger, and also address important state and regional priorities in supporting rural economies (Hatch, Hatch-Multistate). UNHCE education and outreach that supports youth and families and sustaining natural resources are included in the Plan of Work; sustaining natural resources has been consolidate with climate change. However, for the NHAES, research activities in forestry and natural resources are supported by the McIntire-Stennis program and therefore are not described in the Plan of Work.

On July 1, 2011, the University of New Hampshire Cooperative Extension (UNHCE) experienced a 23 percent cut in its state allocation, amounting to a reduction of \$1.7 million. Subsequently, after some staff retirements, resignations, and reductions in force, we now have 20 fewer staff members than three years ago, which creates serious gaps in our ability to provide priority programming throughout the state.

NHAES also suffered a 23.9% cut in state funds in the beginning of July 2011. The primary impacts were a major reduction of farm support staff and contraction in the herd size at the Fairchild Conventional Dairy. This has impacted the scope of applied dairy research, as well as overall ability to provide capacity in support of our agricultural faculty and their competitiveness for external grants funding. The NHAES research portfolio has been refocused, leading to a decrease in number of projects funded and further concentration on research with more direct impact on agriculture and rural economies.

The face of agriculture in New England and New Hampshire is evolving. Even as the overall number of farms in the US continues to decline, the numbers of farms, farm acreage, and farmers is increasing in NH and in all the New England States (2012 Census of Agriculture, preliminary report). The mean age of NH farmers appears to be reaching a plateau at 57.8 years in 2012 as compared to 56.2 years in 2007. Women represent approximately 25% of NH farmers. New and beginning farmers are younger with smaller scale operations. The farm-to-table movement is particularly strong in New England: nearly one quarter of NH farms have direct sales to consumers and NH ranks first in the nation for this statistic (USDA National Agricultural Statistics, New England Field Office.) Summer and fall farmers markets, and farm stands, are widespread. Over the last five years, robust winter farmers markets across the state have become highly successful ([www.agriculture.nh.gov](http://www.agriculture.nh.gov)). The proximity of agricultural operations to U.S. population centers represents a unique facet of the Northeast region, and a distinctive feature relative to education, research and extension within other regions.

Many NH farms are small and diversified. NH farms produce 90,000 gallons of maple syrup. Bee keepers raise bees for honey and to provide crop pollination. "You pick" berry and fruit operations are widespread. Specialty livestock, including goats, rabbits, sheep, and other animals are grown for wool and fiber. Larger commodities include Christmas trees (\$3 million); apples (\$9 million); and livestock (beef, sheep, swine, and poultry) raised for home, local restaurants, and commercial sales (\$33 million). The largest agricultural commodity groups in NH include pleasure horses (\$50 million), dairy (\$62 million) and ornamental horticultural (\$276 million). The most recent estimate of the overall value of the NH agricultural industry (2011) is \$850 million, with direct sales of agriculture and horticultural products and services valued at \$479 million, plus \$379 million in direct spending by agriculture-related tourism (fairs, scenic travel, etc.; [www.agriculture.nh.gov](http://www.agriculture.nh.gov)).

The overarching goal of NHAES 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. NHAES and UNHCE research, outreach, and educational programs emphasize the sustainability of NH's 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.

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. The goal of the program is to catalyze coordinated regional research on high priority needs for northern New England in experiment station mission areas. The program awards seed grants to regional integrated research teams (researchers and extension professionals) through an annual competition. The first project funded under this initiative assesses the potential for the emergence of new cropland weeds in the Northern New England Region (NNE) as a consequence of climate change.

Additional synergies between NHAES Project Directors and UNHCE will develop from the recently formed Applied Agricultural Research Working Group, consisting of members of the UNHCE's Food and Agriculture Extension Specialists and several agroecosystem faculty hired over the last four years. These meetings will be occasionally supplemented with meetings including emeritus faculty and extension specialists. These add to ongoing collaboration between NHAES dairy researchers and Dairy Extension Educators.

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

Year	Extension		Research	
	1862	1890	1862	1890
2015	75.0	null	22.0	null
2016	75.0	null	22.0	null
2017	75.0	null	22.0	null
2018	75.0	null	22.0	null
2019	75.0	null	22.0	null

**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 sponsored-research projects: Faculty are encouraged to submit a one-page description of their proposed project and meet with the NHAES Director or Faculty Fellow to discuss the anticipated work. Faculty are encouraged to use CRIS 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 full proposals.

Proposals submitted to the NHAES are critically reviewed for merit by a committee consisting of highly accomplished faculty members, plus the Director and 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 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 as coordination with Cooperative Extension, outreach, training of undergraduates and graduate students, and incorporation into University courses.

UNH Cooperative Extension uses county advisory councils, comprised of program users, decision makers, and community leaders, to annually review updates to county and state plans of work. These councils meet monthly, in all ten counties, with staff and Extension administration. Furthermore, a state Extension advisory council meets two or three times per year to discuss new programming initiatives and make recommendations to the Dean and Director of Cooperative Extension.

### **III. Evaluation of Multis & Joint Activities**

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

The NHAES and UNHCE fund participation in educational programs and 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. Extension programs address production and marketing issues in agriculture, building a stronger economy throughout the state and strengthening youth and families as well.

The NHAES Director's Office and faculty members maintain connections to critical issues through fostering professional contacts with varied stakeholder groups, 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. NHAES multi-state research projects address aspects of animal and plant agriculture that include the breeding of suitable varieties for our area, pollinator health, climate change, sustainable agriculture, and supporting economies of rural communities.

Which projects NHAES participates in is also influenced by available faculty expertise.

The NHAES actively encourages 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.

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

UNH Cooperative Extension staff is committed to increased programming for under-served and under-represented audiences in New Hampshire. These individuals participate mainly through program efforts in Nutrition Connections, part of the state's welfare reform effort. 4-H after school programs also involve a significant number of under-served families. Staff working in these programs builds trust and rapport with under-represented audiences, and helps Extension advisory councils understand the audiences' needs and circumstances.

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 and the fledgling aquaculture industry along the New Hampshire seacoast.

The NHAES includes a focus on organic dairy farmers who are an under-served agricultural population. The Northeast produces approximately 25% of the organic milk in the country and the market has seen strong increases in demand over the last decade. The NHAES Organic Dairy Research Farm is the only facility of its kind in the Northeast. The NHAES is leading research efforts to reduce the costs of inputs (e.g., bedding, forage, energy), 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 (OREI) to improve the quality, production, and marketing of milk.

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

UNH Cooperative Extension program development using the logic model requires the planner to closely examine the relationship between outputs and desired outcomes of a program. In doing so, extraneous activities that do not lead to desired outcomes can be revised, eliminated, or spun off to another organization that would be more appropriate for conducting the activity. Formative evaluation plays a key role in determining whether or not a program is being implemented effectively and how it might be improved. This kind of on-going evaluation will enable staff to make modifications to their programs on a regular basis, constantly improving program effectiveness.

Newly defined UNH Cooperative Extension program teams bring expertise together to work on critical issues that require multiple perspectives and innovative teaching methods. Programs that have a multidisciplinary scope are expected to be more effective and make

more efficient use of staff time and resources because they will make better use of existing staff expertise to solve the problems and address challenges of the people of New Hampshire. The Cooperative Extension staff uses a web-based planning and reporting system, developed to integrate disciplinary and interdisciplinary extension outcomes that insure a comprehensive and efficient way to meet the most critical issues identified by stakeholders and staff.

By organizing NHAES-supported individual research projects around planned programs serving national and regional priorities, the Director's office has been able to refocus the research activities to target outputs and outcomes to agricultural and rural economy priorities. However, many NHAES projects, especially those discovery research, do not readily lend themselves to the logic model of program development. Furthermore, as one of the smaller state agricultural experiment stations, the NHAES cannot tackle every issue.

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

Interaction between NHAES researchers and multistate colleagues provides synergies; opportunities 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 state agricultural experiment stations by preparing proposals to the Organic Agriculture Research and Extension Initiative (OREI) and Sustainable Agriculture Research and Education organization (SARE). The Northern New England Regional Collaborative Research Funding is another example of joint SAES activities that will impact regional priorities. These new collaborations strongly leverage NHAES support with substantial amounts of competitive funding that is directed to common themes of strategic importance.

### **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 the general public
- Survey of selected individuals from the general public
- Other (County Advisory Councils, comments from research proposals and manuscript reviews.)

### **Brief explanation.**

Stakeholders were encouraged to provide input to NH Cooperative Extension in a variety of ways and across the state. Each county meets regularly with their County Advisory Council and the State Advisory Council (made up of members from each county, and representatives from various partner organizations) meets 2-3 times each year.

NHAES encourages input from stakeholders by multiple means, and from various target groups. The NHAES External Advisory Committee, consisting of farmers, agriculture, aquaculture, ornamental horticulture and forest industry meets formally once a year to provide direct input to the NHAES. The Director and Faculty Fellow interact with these individuals throughout the year. Research presentations and meetings are targeted to both traditional and non-traditional stakeholder groups and individuals. Events range from twilight meetings at horticultural/agronomy farms (offered jointly with Cooperative Extension), Research Field Days at farm and greenhouse facilities, various open houses and farm day events, an educational session and informational booth at NH Farm and Forest Expo, and other venues, and YouTube videos of research presentations for various stakeholder groups. Public events are announced using a variety of media: NH Farm Bureau's Communicator, the Department of Agriculture, Food and Marketing's NH Weekly Market Bulletin, via a Google Group (NHAGCOMM, town agricultural commissions across the state), by direct mail to farmers, and through targeted UNHCE newsletters ([nhvegfruitnews.wordpress.com](http://nhvegfruitnews.wordpress.com); dairy briefs). Nontraditional stakeholders are being increasingly engaged to inform and assist in our efforts to emphasize sustainable agricultural and food systems research.

The NHAES Director's office has recently been reorganized, allowing the addition of an information and communications coordinator in April 2014. The NHAES Advisory Board had recommended working to improve the visibility of the experiment station, and help stakeholders to recognize the distinct roles of research (NHAES), and Cooperative Extension, in contrast to the educational mission of the College of Life Science. This individual will develop a communications plan to better disseminate NHAES information and impacts to both traditional and nontraditional stakeholders, and provide a consistent interface to collect input from stakeholders and communicate input to appropriate members of NHAES. This individual is expected to enhance the visibility of the NHAES in the state. Better recognition of the activities and impacts of the NHAES are essential to engaging stakeholder input and participation.

Specific research projects seek input from stakeholders by surveys (telephone, in person, mail and web-based) and focus groups. Research presentations at scientific conferences, multistate project meetings, mass media, publications, and university classroom and educational programs aimed at K-12 represent additional forums to get stakeholder input.

## **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 External Focus Groups
- Needs Assessments
- Use Surveys

**Brief explanation.**

Cooperative Extension's identification of stakeholders and groups is accomplished primarily through local and state-wide advisory committees. Care is taken to recruit advisory committee members that represent a broad array of interests, background, and residency, including youth and under-served audiences.

The NHAES identifies stakeholders through interaction with: UNH Cooperative Extension; the NH Department of Agriculture, Markets and Food; the NH Farm Bureau, the New England Farm Union, Northeast Organic Farming Association, as well as various trade organizations and community groups across the state and region. Input will be evaluated to identify the most critical issues and those for which NHAES researchers have appropriate expertise to make effective contributions. Special efforts have been made to solicit feedback from members of the NH state legislature's environment and agriculture committee, as well as NH's congressional delegations.

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

**Brief explanation.**

UNH Cooperative Extension's program plan of work addresses high priority needs in New Hampshire identified through on-going counsel with local and a state-wide advisory councils. In addition, Advisory Council members, county and state staff, faculty, and other stakeholders take part in ongoing specific program reviews (conducted by program staff).

Results of program reviews, along with input from stakeholder groups, determine program priorities that would be continued in a reorganized UNH Cooperative Extension. These program reviews include focus groups, web-based stake holder surveys and staff surveys as well.

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.

The NHAES continues 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 (<http://www.colsa.unh.edu/aes/facilities>). The new NHAES communicator and information coordinator will consider new approaches to collect and use input from stakeholders.

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

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

#### **Brief explanation.**

See previous (methods to collect).

Formal and informal stakeholder input to Project Directors, Extension Specialists, 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 and UNHCE activities and goals, 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. The NHAES and Cooperative Extension are continually working to facilitate constituent input, focus available 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	Food Safety
3	Global Food Security and Hunger
4	Climate change and sustaining natural resources
5	Supporting a Rural Economy
6	Youth and Family

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

**Program # 1**

**1. Name of the Planned Program**

Childhood Obesity

**2. Brief summary about Planned Program**

NHAES supports needed research to elucidate the combination of individual and environmental factors associated with unhealthy weight gain among college students. By recognizing that a myriad of environmental and individualized factors can influence eating behavior and lifestyle choices, tailored intervention strategies that have both an environmental and individual focus can begin to be developed. Additionally, identification of the individual factors and the necessary environmental factors to support the individual change is the first step in the development of indexes for comparisons and benchmarking to support policies and programs for behavior change on college campuses and communities.

UNH Cooperative Extension programs that combat childhood obesity include nutrition education programming for limited resource audiences - supported by state funding as well as the Expanded Food and Nutrition Education Program (EFNEP) and Supplemental Nutrition Assistance Program-Education (SNAP-ed) funds. Further NH's 4-H youth development program includes healthy living curriculum for youth, ages 5 - 18.

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

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

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

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

**V(B). Program Knowledge Area(s)**

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior	50%		100%	
704	Nutrition and Hunger in the Population	50%		0%	
	<b>Total</b>	100%		100%	

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

**1. Situation and priorities**

Physical activity and nutrition play vital roles in overall health. Research has found that diet is associated with leading causes of death; many are preventable: heart disease, diabetes, obesity and several types of cancer. While rates of overweight and obesity continue to escalate, those with lower incomes have the highest rates of overweight and obesity. Among low income preschool children, 1 in 3 is

obese or overweight before their 5th birthday. However, lifestyle choices (along with other environmental factors and genetics) have a power influence on one's health and quality of life.

Young adults are at a unique risk for weight gain because of rapidly changing social situations that influence exercise and eating behaviors. Research is needed to elucidate the factors associated with unhealthy weight gain among college students. NHAES provides basic and applied research to undergraduate curriculum in Nutrition and to its educational programs in Extension.

## **2. Scope of the Program**

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension
- 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 and nutrition education programming.

Other assumptions:

- Over the last century, changes in production agriculture and food processing have subtly impacted how children and adults metabolize and store food.
- Despite extensive efforts to promote weight management, these efforts only reach a small proportion of the population at risk and even effective programs promoting individual behavior change may have limited effectiveness in environments that promote weight gain.
- Research is needed to elucidate the combination of individual and environmental factors associated with unhealthy weight gain among college students.
- Nutrition education leads to healthy changes in behavior.

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

- Effective education interventions to modify diet and physical activity in children and adults that results in improved healthy trajectories.
- Identification of the individual factors and the necessary environmental factors to support improved health is the first step in the development of indexes for comparisons and benchmarking that support policies and programs for behavior change on college campuses and communities.
- Increase quality of health and nutrition choices (e.g., physical activity, menu choices) made by NH families, primarily within low income and 4-H communities.

**V(E). Planned Program (Inputs)**

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

Year	Extension		Research	
	1862	1890	1862	1890
2015	11.0	0.0	0.3	0.0
2016	11.0	0.0	0.3	0.0
2017	11.0	0.0	0.3	0.0
2018	11.0	0.0	0.3	0.0
2019	11.0	0.0	0.3	0.0

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

**1. Activity for the Program**

**Cooperative Extension:** Nutrition Connections--educational courses to income eligible NH residents--will be available through the Expanded Food and Nutrition Education Program (EFNEP) and Supplemental Nutrition Education Program (SNAP-ed).

**NHAES:** A Healthy Campus Index developed will be developed based on results of previous online assessments of individual and environmental factors that influence eating behavior and lifestyle choices on college campuses. Participating institutions will be scored using the index. Results will be reviewed with participatory research committees and administrators, and the Index will be revised as necessary. Funding support will be sought for reliability and validity testing, benchmarking, and intervention studies associated with the Health Campus Index.

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

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● Education Class</li> <li>● Group Discussion</li> <li>● One-on-One Intervention</li> </ul>	<ul style="list-style-type: none"> <li>● Newsletters</li> <li>● Web sites other than eXtension</li> </ul>

**3. Description of targeted audience**

Limited resource youth, ages 0-18 and young adults (undergraduate and graduate students)

Research projects benefit other nutrition and health scientists, dietitians and health professions, as well as undergraduate and graduate students in UNH nutrition courses. Activities are integrated with the other Land Grant Institutions who participate in NC1193.

## 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 websites in which project results have been incorporated
- Number of low-income adults participating in Nutrition Connections - educational courses to income eligible New Hampshire residents
- Number of youth participating in nutrition programming through Nutrition Connections
- Number of youth participating in 4-H Healthy Living programs

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	In collaboration with other SAES, develop a Healthy Campus Index and assess participating institutions.
2	Number of graduate students involved and trained in engagement research.
3	Number of participants who report an increase in their physical activity
4	Number of youth who learn how to choose foods according to the Pyramid and Dietary Guidelines
5	Number of participants who report eating nearer to the recommended number of cup equivalents from the Fruits and Vegetable Group

**Outcome # 1**

**1. Outcome Target**

In collaboration with other SAES, develop a Healthy Campus Index and assess participating institutions.

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

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

- 703 - Nutrition Education and Behavior

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

- 1862 Research

**Outcome # 2**

**1. Outcome Target**

Number of graduate students involved and trained in engagement research.

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

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

- 703 - Nutrition Education and Behavior

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

- 1862 Research

**Outcome # 3**

**1. Outcome Target**

Number of participants who report an increase in their physical activity

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

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

- 703 - Nutrition Education and Behavior



#### **4. Associated Institute Type(s)**

- 1862 Extension

#### **Outcome # 4**

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

Number of youth who learn how to choose foods according to the Pyramid and Dietary Guidelines

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

##### **3. Associated Knowledge Area(s)**

- 703 - Nutrition Education and Behavior
- 704 - Nutrition and Hunger in the Population

#### **4. Associated Institute Type(s)**

- 1862 Extension

#### **Outcome # 5**

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

Number of participants who report eating nearer to the recommended number of cup equivalents from the Fruits and Vegetable Group

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

##### **3. Associated Knowledge Area(s)**

- 703 - Nutrition Education and Behavior
- 704 - Nutrition and Hunger in the Population

#### **4. Associated Institute Type(s)**

- 1862 Extension

### **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
- Populations changes (immigration, new cultural groupings, etc.)

### **Description**

Changes in funding and resource availability for the activities, and in policies or regulations related to Research and Extension using human subjects, would compromise the feasibility of completing the objectives. The current Federal and State budgetary limitations, combined with recent State reductions in capacity funds (2012), will impact the direct support of personnel or facilities and limit our abilities to complete the proposed NHAES and Extension activities.

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**

- Food recalls and surveys of Extension clientele
- NHAES and UNHCE will evaluate the outcomes and impacts by monitoring for continued synergy between researchers and Extension to disseminate current findings to stakeholders.
- NHAES will evaluate the outcomes and impacts of research activities by monitoring ongoing publication in peer-reviewed journals.

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

### **Program # 2**

#### **1. Name of the Planned Program**

Food Safety

#### **2. Brief summary about Planned Program**

Cooperative Extension Food Safety programs focus on training and resources for food handlers in restaurants, schools and other institutions as well as consumer education around food safety.

The safety of agricultural and aquaculture food products is important to all consumers within NH, and specific concerns are targeted by NHAES research. Outcomes will improve the safety of food products grown, harvested or produced and consumed locally, regionally, and nationally. Current thrusts of NHAES research and outreach in food safety combine basic and applied research that:

- defines commonalities and differences in the mechanisms of biofilm adaptation between pathogens and commensal microbes of agriculturally important plants and animals, to understand how biofilms impact plant and animal health.
- addresses the emergent problem of pathogenic Vibrios in shellfish in the Northeast
- seeks to understand and ameliorate the pathways by which domestic animals and humans are exposed to microcystin toxins produced by cyanobacterial blooms in freshwater lakes and drinking water reservoirs.

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

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

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

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

**V(B). Program Knowledge Area(s)**

1. Program Knowledge Areas and Percentage

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
133	Pollution Prevention and Mitigation	0%		4%	
135	Aquatic and Terrestrial Wildlife	0%		21%	
212	Pathogens and Nematodes Affecting Plants	0%		7%	
215	Biological Control of Pests Affecting Plants	0%		7%	
311	Animal Diseases	0%		7%	
501	New and Improved Food Processing Technologies	0%		7%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	10%		10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	45%		30%	
723	Hazards to Human Health and Safety	45%		7%	
	<b>Total</b>	100%		100%	

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

1. Situation and priorities

**Cooperative Extension situation and priorities**

The US Centers for Disease Control and Prevention (CDC) estimates that each year approximately 1 out of 6 Americans or 47.8 million people get sick from a foodborne illness. Of those people who get sick, 128,000 are hospitalized and 3,037 die from their illness. The Produce Safety Project supported by The Pew Charitable Trust and Georgetown University published a study in 2010 estimating the annual cost of foodborne illnesses is \$152 billion. This study estimated the per-case cost for an individual is \$1,850.

Further, this report assessed the annual health-related cost of foodborne illness by state. For New Hampshire, the estimated annual cost of foodborne illness was \$681 million with a per case cost estimate of \$1,892. In 2012, New Hampshire restaurants are projected to record \$2.3 billion in sales while employing 63,800 people and many of these employees have no or limited training in food safety. Although consumer awareness of food safety hazards has increased, survey results indicate that the youngest and oldest consumers and those with the highest education have the least safe food safety practices.

**NHAES research situation and priorities are in three areas:**

- Microbial growth, as biofilms, represents the predominant microbial life style on the planet, yet little is understood about the ecology and physiology of biofilms. 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 subtropical waters, these have become an emergent problem in New England with resulting health concerns and impacts on a resurgent shellfish industry. Both pathogenic and avirulent (non-pathogenic) strains of *V. parahaemolyticus* and *V. vulnificus* are common to the coastal estuaries, however there are currently no rapid laboratory methods to distinguish between benign and pathogenic strains. 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. Relay treatments may reduce *Vibrio* loads in oysters, but new methods are needed to distinguish pathogenic strains to improve monitoring and prevent outbreaks of these diseases for oyster growers and shellfish consumers.

- 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
- Multistate Extension
- Integrated Research and Extension

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

### 1. Assumptions made for the Program

The overriding assumption is that funding remains adequate to address food safety research and educational needs in NH.

#### **Other assumptions relevant to Cooperative Extension include:**

- People are willing to pay fees associated with ServSafe and SAFE training sessions.

#### **Assumptions relevant to NHAES Research Activities include:**

- 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. 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 northern temperate coastal waters in relation to emerging U.S. FDA guidelines.

- Cyanobacterial blooms that produce toxic microcystins will continue in the state and region.

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

**Cooperative Extension:** New Hampshire citizens have access to safe food.

**NHAES research goals include:**

- Increasing our understanding of bacterial biofilms and how these may be managed to enhance crop productivity and/or to minimize disease.
- Elucidating environmental and biological conditions and pathways that are useful for reducing or avoiding exposure to elevated levels of pathogenic *Vibrio* species.
- Improve monitoring and management of freshwater lakes cyanobacteria blooms to limit the accumulation of microcystin neurotoxins in watershed soils, vegetation surrounding lakes, or on garden fruits and vegetables that are irrigated with contaminated waters. The latter are all potential modes of animal and human exposure to toxic 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
2015	3.0	0.0	3.2	0.0
2016	3.0	0.0	3.2	0.0
2017	3.0	0.0	3.2	0.0
2018	3.0	0.0	3.2	0.0
2019	3.0	0.0	3.2	0.0

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

**1. Activity for the Program**

**Cooperative Extension food safety programs:**

- SAFE (Safety Awareness in the Food Environment) Programs
- ServSafe®

Several different NHAES research projects are conducted under this program. 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 pathogenic 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
<ul style="list-style-type: none"> <li>• Education Class</li> <li>• Workshop</li> <li>• One-on-One Intervention</li> </ul>	<ul style="list-style-type: none"> <li>• Newsletters</li> <li>• Web sites other than eXtension</li> </ul>

**3. Description of targeted audience**

**Cooperative Extension** Food Safety education: Food handlers at restaurants, schools, health facilities, etc. and the general public.

**The target audiences for NHAES research activities** include both discrete and overlapping groups:

- For bacterial biofilms, the targeted audience 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 targeted 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 people who participate in ServSafe workshops
  - Number of adults participating in food safety programming through Nutrition Connections - educational courses to income-eligible New Hampshire residents
  - Number of people who participate in SAFE (Safety Awareness in the Food Environment) programs
  - Number of undergraduate students directly involved in the research 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 method
- 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 program participants who score 75% or greater on knowledge tests of high risk practices including: * Personal hygiene * Holding/time and temperature * Cooking temperatures * Prevention of contamination
2	Number of food handlers who self-report an intent to adopt recommended hand washing practices, take steps to reduce cross-contamination and/or use proper time and temperature controls after attending a SAFE program.
3	Continued development of improved Vibrio detection methods and post-harvest treatments for <u>reducing Vibrio levels in shellfish to address growing regional concerns.</u>
4	Number of agencies and stakeholder groups involved in research outreach related to Vibrios in shellfish.
5	Increased knowledge about mechanisms of biofilm adaptation and diversification in pathogens and symbionts.
6	Knowledge about the changes in Vibrio genomes, which cause transitions to virulence;
7	Understanding of how microcystin toxins spread from lakes to the terrestrial food chain

**Outcome # 1**

**1. Outcome Target**

Number of program participants who score 75% or greater on knowledge tests of high risk practices including:

- \* Personal hygiene
- \* Holding/time and temperature
- \* Cooking temperatures
- \* Prevention of contamination

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

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

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 723 - Hazards to Human Health and Safety

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

- 1862 Extension

**Outcome # 2**

**1. Outcome Target**

Number of food handlers who self-report an intent to adopt recommended hand washing practices, take steps to reduce cross-contamination and/or use proper time and temperature controls after attending a SAFE program.

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

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

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 723 - Hazards to Human Health and Safety

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

- 1862 Extension

**Outcome # 3**

**1. Outcome Target**

Continued development of improved Vibrio detection methods and post-harvest treatments for reducing Vibrio levels in shellfish to address growing regional concerns.

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

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

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 723 - Hazards to Human Health and Safety

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

- 1862 Research

**Outcome # 4**

**1. Outcome Target**

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

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

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

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 723 - Hazards to Human Health and Safety

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

- 1862 Research

**Outcome # 5**

**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

#### **4. Associated Institute Type(s)**

- 1862 Research

#### **Outcome # 6**

##### **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)**

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 723 - Hazards to Human Health and Safety

##### **4. Associated Institute Type(s)**

- 1862 Research

#### **Outcome # 7**

##### **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**

Changes in funding and resource availability for the activities and in policies or regulations related to NHAES research and Cooperative Extension 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 capacity funds, will impact the direct support of personnel or facilities and limit our abilities to complete the proposed research and Extension activities.

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.

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**

**Cooperative Extension:** A post-workshop knowledge questionnaire will be administered after each SAFE program. Examination scores of the ServSafe® program's participants will be used to ascertain food safety and sanitation knowledge. Participants in both SAFE and ServSafe® programs will complete another questionnaire to assess intent to implement recommended food safety and sanitation practices.

**NHAES 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 the adoption of new risk-management strategies by stakeholders (commercial shellfish operations, watershed associations).

**Cooperative Extension and NHAES will:**

- Continue to gage synergies between researchers and extension to disseminate up-to-date findings to stakeholders.

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

### **Program # 3**

#### **1. Name of the Planned Program**

Global Food Security and Hunger

#### **2. Brief summary about Planned Program**

The University of New Hampshire Cooperative Extension's Food and Agriculture Program Team delivers information and technical assistance to New Hampshire citizens involved in agriculture for profit or to achieve their own personal goals. Extension's role is unique because our Food and Agriculture staff members provide current, research-based educational programming to farmers, horticultural businesses, and gardeners, allowing them to make their own informed decisions. Food and Agriculture specialists are trusted partners in the pursuit of sustainable and productive local agriculture.

Plant and animal agriculture are integral components of the past and future New Hampshire and New England landscapes. A primary aspect of NHAES animal agriculture research is the dairy industry. Several projects focus on improving profit margins for the dairy producers in the Northeast: one project's goals are to identify alternative protein feeds-- which could be grown locally--to reduce the cost of protein feeds bought off farm while maintaining milk production; another project will seek to optimize calf and heifer performance through an increased understanding of feeding strategies and management systems while other program participants study aspects of ruminant fertility, as low fertility in US dairy herds is a significant challenge to overall milk production.

The second primary area of NH food production is in vegetables and small fruits. Among our horticultural crop research projects, our longtime cucurbit breeder will use conventional breeding techniques to develop squash, melon, gourd, and pumpkin varieties with improved taste, nutrition, appearance, disease resistance, and suitability for regional climate conditions. In another project, information from the strawberry genome project will be used for the first time in marker-assisted breeding to speed the development of improved strawberry varieties. Additional projects include evaluating the characteristics and adaptation of vegetable and fruit varieties to develop management techniques that extend the growing season, increase profitability, reduce environmental impact, or improve efficiency of vegetable and fruit cropping systems in NH. Weeds are one of the largest problems in sustainable crop production. One researcher will help to determine weed management strategies for sustainable cropping systems, including those under organic production. Another project is examining genetic relationships between the fungal pathogens of regional crops, which impacts recommended crop rotations, and developing more sustainable methods of integrated pest management. In addition, "bar-coding" and other molecular methods will be used to investigate the biodiversity and genetic diversity of native bee species, which have important roles as plant pollinators.

Some research will be more fundamental in nature, leading to future enhancements to management strategies. One researcher will identify key reproductive hypothalamic and pituitary hormones, which are important in helping to control reproduction in commercially valuable fish species used in aquaculture among multiple other applications. Another project examines the microbes associated with a plant parasitic nematode pest to understand how the nematode's microbiome contributes to plant disease. A third project is targeting phosphodiesterase inhibitors as potential control agents for parasitic nematodes. Another project will increase the understanding of actinorhizal symbiosis between beneficial Frankia microbes and plants, which represents an important ecological and economic role in agriculture and the environment. Mechanisms of communication between these plants and microbes will be evaluated toward future increases in agricultural production through the development of tools that will allow for the genetic analysis of Frankia physiology and the interactions of Frankia with its host plants. Yet another project will

develop genomic resources for barberries (*Berberis* spp.), an ornamental plant that is wide-spread in the Northeast. Barberry is an alternative host for wheat stem and stripe rusts (*Puccinia* spp.). One goal of this research is to identify the genetic mechanism(s) of resistance to *Puccinia graminis* f.sp. *tritici* in the alternate host *Berberis* spp. This is a novel approach to understanding and breeding for durable resistance to wheat stem rust.

Integrated NHAES research and Cooperative Extension efforts in this area are supported through partial funding for one faculty member with a joint appointment. Effective synergies with national colleagues are facilitated through affiliations with seven multistate research projects. In the global food security and hunger program, nine NHAES scientists participate in the multistate research associated with Global Food Security and Hunger.

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

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

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

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



**V(B). Program Knowledge Area(s)**

## 1. Program Knowledge Areas and Percentage

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
102	Soil, Plant, Water, Nutrient Relationships	20%		0%	
136	Conservation of Biological Diversity	0%		2%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		10%	
202	Plant Genetic Resources	0%		10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		5%	
204	Plant Product Quality and Utility (Preharvest)	0%		5%	
205	Plant Management Systems	20%		0%	
211	Insects, Mites, and Other Arthropods Affecting Plants	15%		0%	
212	Pathogens and Nematodes Affecting Plants	15%		5%	
213	Weeds Affecting Plants	0%		7%	
216	Integrated Pest Management Systems	15%		0%	
301	Reproductive Performance of Animals	0%		13%	
302	Nutrient Utilization in Animals	0%		5%	
304	Animal Genome	0%		2%	
305	Animal Physiological Processes	0%		10%	
307	Animal Management Systems	0%		3%	
311	Animal Diseases	0%		10%	
315	Animal Welfare/Well-Being and Protection	15%		0%	
502	New and Improved Food Products	0%		5%	
903	Communication, Education, and Information Delivery	0%		8%	
	<b>Total</b>	100%		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 the NHAES' largest research effort and a significant proportion of Cooperative Extension Programing. 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.

**Animal production and forage crops** are an important part of agriculture in New Hampshire, which includes commercial farms in a wide range of scales and production systems and small-scale 'homestead' operations focused on limited marketing or home food production. The value of products from dairy, livestock, and poultry operations from these farms across the state exceeds \$95 million (agriculture.nh.gov). The forage, pasture, and silage corn crops that support this sector cover over 100,000 acres, more than 90% of the cropland in the state.

The number of farms that produce **vegetables and fruits** is increasing in New Hampshire, and consumer interest in locally grown food has expanded in recent years throughout New England. Between 2002 and 2007, the number of vegetable farms increased 36% and the number of orchards increased 28%. Preliminary results of the 2007-2012 Agriculture Census shows another 5.4% increase in the number of farms and a slight (0.4%) increase in total farm acreage in NH (<http://www.agcensus.usda.gov/Publications/2012/>). New Hampshire agriculture is dominated by small, diversified farms. The average and median size of NH farms have decreased by 5% and 16% respectively over the last census period. The market value of agricultural products also was down 5% over this period, possibly linked to the impact of the Great Recession. More young and first time farmers are joining the NH farming community. Although still a very small fraction of the total farm population, the number of nonwhite farmers in NH nearly doubled from 33 to 65 over the period covered by the most recent Agricultural Census.

NHAES research in Global Food Security and Hunger ranges from basic to applied agricultural/aquaculture research. Two research and teaching dairies are supported: one is a conventional Holstein operation based on total mixed ration feeding. The second is an organic dairy-based agroecosystem with pasture-fed Jersey cows. A cohort of Jerseys was added to the conventional dairy to allow direct comparisons of organically and conventionally managed cows. These facilities support basic and applied research in areas of significant importance to the dairy industry: addressing the issue of low overall fertility of dairy cows, enhancing neonatal calf growth, and testing the efficacy of both organic and conventional food supplements for dairy cattle. During the ~seven months of the year when pasturing in New England is not possible, conserved forages are fed to dairy cattle. In the winter, protein grain supplements must be used to buffer the lower nutritional value of hays. The protein grain supplements are purchased off-farm and are the most expensive ingredient in the dairy cow diet. These contribute to the production costs that have been cited as one of the most challenging aspects of sustaining organic dairying. Research is necessary to extend the pasturing season in New England and identify alternative protein supplements that will be more cost effective for organic and conventional dairy farmers. Results of NHAES dairy research are quickly disseminated to the state and regional stakeholders via ongoing collaboration with Cooperative Extension.

Two horticultural/agronomy farms and a greenhouse complex for vegetable and fruit breeding provide capacity for the research, teaching, and demonstration projects of NHAES scientists, Cooperative Extension Faculty, and local staff of the National Resources Conservation Service (NRCS). A portion of one horticultural farm has transitioned to organic certification to enable research that addresses issues of importance to that agricultural segment.

America's abundant and inexpensive supply of food and fiber 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. Genetic diversity continues to be essential for plant breeders and other scientists as they breed new varieties that are important to

improved flavor, higher yields and better storage properties of squash and pumpkins. A new hearty kiwi orchard has been established at the Woodman Farm for breeding valuable niche market fruit.

There are many production challenges that are unique to NH and New England conditions. 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; new plant and animal pathogens and pests become significant as a consequence of climate change. 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 the use of chemical pesticides, minimize crop production costs, maintain high crop quality and yields, and have reliable and consistent markets for their products.

Globally, the demand for seafood continues to rise while many wild fish stocks are at or beyond sustainable harvest levels. For example, the lucrative sea urchin fishery in the Gulf of Maine collapsed due to overfishing. To meet rising consumer demand, much of the production will depend on continued growth in the aquaculture industry. Expanding aquaculture requires research in improved production systems (sea urchins, oysters) and practical approaches to reducing the environmental impact of finfish aquaculture (water quality problems and the reliance on fish meal-based diets derived from wild harvested fish). There is growing interest in NH in aquaponics, which combines conventional aquaculture with hydroponics. Research is needed to develop high value production systems that are appropriate for Northern New England.

## **2. Scope of the Program**

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

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

### **1. Assumptions made for the Program**

The sustainability of agriculture in NH requires a holistic approach that interfaces production, human resources, economic and environmental issues, and civic policies. All must be addressed at some level.

Most national research on plant 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 the 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.

Identifying alternative protein feeds and extending the pasturing season will improve the profitability of northern New England dairy farms. Aquaculture will expand as cost effective and environmentally sound production practices for New England are identified.

Support dollars for NHAES and Cooperative Extension 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**

The Cooperative Extension and NHAES goals are complementary.

**Cooperative Extension** goals will ensure that:

- Agriculture preserves the integrity of New Hampshire's natural resources.
- Agricultural businesses in New Hampshire are profitable and economically sustainable in the long-term future.
- High quality agricultural products are available to New Hampshire citizens.
- New Hampshire citizens have improved year-round access to locally-grown agricultural products.
- New Hampshire citizens have access to safe food.
- Agriculture contributes to New Hampshire's high quality of life.

**NHAES** goals are to:

- Increase an understanding of and abilities to produce agricultural food products.
- Address state, regional, and international food security, consistent with maintaining environmental quality.
- Contribute to the abilities of New Hampshire and regional stakeholders to maintain viable agricultural businesses and careers.
- 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
2015	10.0	0.0	12.0	0.0
2016	10.0	0.0	12.0	0.0
2017	10.0	0.0	12.0	0.0
2018	10.0	0.0	12.0	0.0
2019	10.0	0.0	12.0	0.0

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

**1. Activity for the Program**

Cooperative Extension

- Workshops/conferences - including single- and multi-day conferences, Farm and Forest events, and various producer association meetings
- Pasture walks & twilight meetings
- Farm/site visits, including kitchen table meetings and private consultations
- On-farm and university-based applied research projects
- Phone consultations
- Soil and plant tissue diagnostic services
- Publications - newsletters, news releases, fact sheets, publications, web page
- Radio and TV spots

NHAES:

- Conduct applied and discovery research
- Undertake engagement with stakeholders in multiple aspects of plant and animal agriculture, related genetics and genomics, and various types of aquaculture.

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

**Extension**

Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>• Education Class</li> <li>• Workshop</li> <li>• One-on-One Intervention</li> <li>• Demonstrations</li> </ul>	<ul style="list-style-type: none"> <li>• Newsletters</li> <li>• TV Media Programs</li> <li>• eXtension web sites</li> <li>• Web sites other than eXtension</li> </ul>

**3. Description of targeted audience**

**Cooperative Extension and NHAES audiences include:**

Farmers/producers, scientists, veterinarians, agricultural researchers, agricultural teachers, graduate and undergraduate students, and the faculty and staff of the region's land grant universities and others who work in agriculture-related fields, and taxpayers in the state, region and nation.

### **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 farm/site visits, including kitchen table meetings and private consultations
- Number of people reached with agriculture information via radio and TV spots
- Number of Pesticide Applicators attending recertification training
- Number of soil and plant analyses conducted by diagnostic labs
- Number of people reached through educational workshops
- Number of undergraduate students directly involved in the research projects
- Number of graduate students directly involved in research projects.
- Number of university courses in which research project results have been incorporated
- Number of research 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 resulting from research projects
- Number of websites in which research project results have been incorporated
- Number of surveys or other methods used to collect data from participants conducted for research projects
- 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	Number of NH growers who adopt practices that improve farm productivity, quality of life, environmental conditions, and/or profitability.
2	Number of NH growers who submit soil and/or tissue tests to determine crop nutrient needs
3	Number of NH growers who formulate plans to guide their crop production, pest management, nutrient allocation, or farm management decisions
4	Number of NH growers who increase knowledge, awareness, and/or skills in pest management practices and technologies.
5	Number of NH growers who increase their knowledge, awareness, and/or skills in crop production practices
6	Number of NH growers who increase their skills, knowledge or awareness in practices or methods related to dairy, livestock or equine production methods.
7	Increased knowledge about plant varieties and production practices suited to the state and region.
8	New knowledge about dairy production, nutrition, animal health and dairy products important to regional producers.
9	New genomic knowledge translated into tools and strategies to facilitate varietal selection through marker assisted breeding.
10	Improved range of weed management options available for sustainable and organic growers.
11	Develop regionally appropriate management systems to suppress soil borne pathogens for both organic and conventional farms
12	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.
13	New commercialized varieties of cucurbit vegetables suited to state and region growing conditions, with improved yields and disease and pest resistance.
14	Increased information on non-Apis bees, their conservation, pathology, susceptibility to pesticides and contribution to crop pollination including economic value.
15	Develop genomic resources for barberries, to assist with taxonomic problems, and as tools to identify the genetic mechanisms(s) of resistance to wheat stem and strip rusts.
16	Improved equipment and deployment methods developed for oyster aquaculture in Northern New England and disseminated to the growing number of oyster farmers in NH.
17	Establish a breeding program for hardy kiwifruit (Actinidia spp.) cultivars for New England, by characterizing with genetic and molecule tools, and phenotyping hardy Actinidia germplasm obtained the USDA's National Genetic Resources Program.



**Outcome # 1**

**1. Outcome Target**

Number of NH growers who adopt practices that improve farm productivity, quality of life, environmental conditions, and/or profitability.

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

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

- 102 - Soil, Plant, Water, Nutrient Relationships
- 205 - Plant Management Systems
- 315 - Animal Welfare/Well-Being and Protection

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

- 1862 Extension

**Outcome # 2**

**1. Outcome Target**

Number of NH growers who submit soil and/or tissue tests to determine crop nutrient needs

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

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

- 102 - Soil, Plant, Water, Nutrient Relationships
- 205 - Plant Management Systems

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

- 1862 Extension

**Outcome # 3**

**1. Outcome Target**

Number of NH growers who formulate plans to guide their crop production, pest management, nutrient allocation, or farm management decisions

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

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

- 102 - Soil, Plant, Water, Nutrient Relationships
- 205 - Plant Management Systems

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 216 - Integrated Pest Management Systems

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

- 1862 Extension

**Outcome # 4**

**1. Outcome Target**

Number of NH growers who increase knowledge, awareness, and/or skills in pest management practices and technologies.

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

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

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 216 - Integrated Pest Management Systems

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

- 1862 Extension

**Outcome # 5**

**1. Outcome Target**

Number of NH growers who increase their knowledge, awareness, and/or skills in crop production practices

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

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

- 102 - Soil, Plant, Water, Nutrient Relationships
- 205 - Plant Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 216 - Integrated Pest Management Systems

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

- 1862 Extension

### **Outcome # 6**

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

Number of NH growers who increase their skills, knowledge or awareness in practices or methods related to dairy, livestock or equine production methods.

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

#### **3. Associated Knowledge Area(s)**

- 315 - Animal Welfare/Well-Being and Protection

#### **4. Associated Institute Type(s)**

- 1862 Extension

### **Outcome # 7**

#### **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)**

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems

#### **4. Associated Institute Type(s)**

- 1862 Research

### **Outcome # 8**

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

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

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

#### **3. Associated Knowledge Area(s)**

- 302 - Nutrient Utilization in Animals

- 305 - Animal Physiological Processes

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

- 1862 Research

**Outcome # 9**

**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)**

- 201 - Plant Genome, Genetics, and Genetic Mechanisms

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

- 1862 Research

**Outcome # 10**

**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)**

- 213 - Weeds Affecting Plants

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

- 1862 Research

**Outcome # 11**

**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)**

- 212 - Pathogens and Nematodes Affecting Plants

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

- 1862 Research

**Outcome # 12**

**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
- 903 - Communication, Education, and Information Delivery

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

- 1862 Research

**Outcome # 13**

**1. Outcome Target**

New commercialized varieties of cucurbit vegetables suited to state and region growing conditions, with improved yields, and disease and pest resistance.

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

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

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

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

- 1862 Research

**Outcome # 14**

**1. Outcome Target**

Increased information on non-Apis bees, their conservation, pathology, susceptibility to pesticides and contribution to crop pollination including economic value.

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

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

- 136 - Conservation of Biological Diversity
- 304 - Animal Genome

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

- 1862 Research

**Outcome # 15**

**1. Outcome Target**

Develop genomic resources for barberries, to assist with taxonomic problems, and as tools to identify the genetic mechanisms(s) of resistance to wheat stem and strip rusts.

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

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

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources

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

- 1862 Research

**Outcome # 16**

**1. Outcome Target**

Improved equipment and deployment methods developed for oyster aquaculture in Northern New England and disseminated to the growing number of oyster farmers in NH.

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

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

- 305 - Animal Physiological Processes

#### **4. Associated Institute Type(s)**

- 1862 Research

#### **Outcome # 17**

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

Establish a breeding program for hardy kiwifruit (*Actinidia* spp.) cultivars for New England, by characterizing with genetic and molecule tools, and phenotyping hardy *Actinidia* germplasm obtained the USDA's National Genetic Resources Program.

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

##### **3. Associated Knowledge Area(s)**

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 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
- Populations changes (immigration, new cultural groupings, etc.)

##### **Description**

Weather and climate extremes and natural disasters affect the outcomes of field research on plants and animals.

Changes in funding and resource availability for the activities and in policies or regulations related to NHAES research and Cooperative Extension using animals would compromise the feasibility of completing the objectives. The current federal and state budgetary limitations, combined with previous reductions in NHAES and Cooperative Extension capacity funds, will continue to impact the direct support of personnel or facilities and limit our abilities to complete the proposed NHAES research and Extension activities. 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**

- 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 plant and animal production methods.

#### **Cooperative Extension**

Interviews, surveys and on-farm observations



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

### **Program # 4**

#### **1. Name of the Planned Program**

Climate change and sustaining natural resources

#### **2. Brief summary about Planned Program**

Many aspects of climate soils, landform, and vegetation in New Hampshire and New England make this region particularly susceptible to any changes in climate. We are near a northern temperature extreme for some forms of agricultural. As in warmer years, new crops are being introduced to the region at the same time as new insects and pathogens are becoming established. All of these factors make the ability to anticipate, mitigate, and adapt to potential changes in climate a priority for agriculture and for sustaining natural resources.

NHAES research in this program addresses both climate impacts and climate mitigation efforts. In the first research goal is a better understanding of how microbial communities contribute to the formation and breakdown of soil organic matter (SOM) underpin how and when N is available 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. Nutrient run off is a consequence of agricultural and suburban development which exacerbates eutrophication of coastal estuaries.

Another NHAES research goal is to decrease farmers' costs and environmental impacts associated with off farm inputs (animal bedding) and manure disposal. An integrated research project is evaluating the sustainable production of pine shavings from farm wood lots, with aerobic composting of bedding/manure to capture heat for on-farm dairy parlor hygiene. These new practices have the potential to decrease the energy footprint of dairy farming in the Northeast.

UNHCE programs address sustainability and climate change issues by working closely with the State Department of Forest and Lands to provide forest stewardship education to landowners as well as work with communities to help them to make sound policy decisions that will address adaptations to climate change as well as maintaining open space and providing wildlife habitat.

**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

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
101	Appraisal of Soil Resources	0%		20%	
102	Soil, Plant, Water, Nutrient Relationships	0%		20%	
112	Watershed Protection and Management	20%		20%	
123	Management and Sustainability of Forest Resources	40%		0%	
124	Urban Forestry	10%		0%	
131	Alternative Uses of Land	10%		0%	
216	Integrated Pest Management Systems	10%		0%	
403	Waste Disposal, Recycling, and Reuse	0%		20%	
605	Natural Resource and Environmental Economics	10%		20%	
	<b>Total</b>	100%		100%	

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

## 1. Situation and priorities

Many aspects of climate, soils, landform and vegetation in New Hampshire and New England make it particularly susceptible to any changes in climate. The health of New Hampshire's environment depends on sound land use, strong conservation organizations and citizens engaged in natural resource management and conservation to maintain clean water, diverse natural areas and connected wildlife habitats. NH has the greatest proportion of forested land (84%) in the country, most of which is owned and managed by private landowners. However, the state is simultaneously experiencing suburban growth and an increase in the number of small farms. Furthermore, NH soils are thin and shallow bedrock provides less buffering compared with many other parts of the country. The majority of plant agriculture relies on growing season rainfall rather than irrigation.

Understanding the relative contributions of agriculture, forest, and suburban development to nutrient runoff that has compromised the health of Southeastern's NH Great Bay is essential as local municipalities and government agencies seek to mitigate these problems.

A recent survey of Northeastern Dairy farmers identified the costs of off-farm inputs, animal bedding, and energy expenses as two of most significant challenges to farmers' fiscal stability. New technologies and farming practices may be useful to decrease these costs for animal farmers while simultaneously decreasing the ecological footprint of agriculture in the Northeast.

All of these challenges require an interdisciplinary approach at multiple scales to improve the ecological health of New Hampshire.

## **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**

The overriding assumption made for this program is that funding and resources will be available to continue these NHAES research and Cooperative Extension activities.

Additional assumptions include:

- 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 to climate change.
  - Atmospheric N deposition and nutrient run off from agriculture and suburban development is exacerbating the eutrophication of NH Great Bay.

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

Develop and implement research-based educational outreach programs in forest stewardship, urban and community forestry, wildlife, economic viability/sustainability and natural resource conservation helping landowners make informed decisions that will influence the health and productivity of their forests, open space and related resources.

New Hampshire communities, businesses, organizations, and volunteers work together to protect, manage and steward the state's vast natural resources (including agriculture, forests and fisheries) vital to sustaining the state's character and economy, preserving recreational opportunities and maintaining a high quality of life.

NHAES research goals include: improving components of predictive models of climate change, increase the understanding of the relative impacts of nonpoint sources of N in the eutrophication of NH Great Bay, and improving the sustainability of argoecosystems.

### **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
2015	14.0	0.0	2.3	0.0
2016	14.0	0.0	2.3	0.0
2017	14.0	0.0	1.8	0.0
2018	14.0	0.0	1.8	0.0
2019	14.0	0.0	1.8	0.0

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

**1. Activity for the Program**

**NHAES researchers will:**

- Compare new methods for assessing microbial efficiency as it impacts soil C storage and greenhouse gas emissions.
- Investigate the effects of different cropping systems, soil insects, and microbial communities on Soil Organic Matter (SOM) and soil nitrogen cycling.
- Investigate climate impact on soil C cycling to improve the Community Land Model, a component of climate change assessments.
- Monitor the flux of N from agricultural, suburban and forested lands, and atmospheric N deposition as these impact the nutrient status of the Great Bay estuary.
- Refine economic models of on-farm production of animal bedding, static-pile aerobic composting with heat extraction, and uses of the finished compost as soil amendments.
- Disseminate information about these new practices to improve

**Cooperative Extension** will carry out applied research, field trials and publishing research reports including:

- Development of educational Information: newsletters (including e-newsletters), fact sheets, trade-magazines, journals, posters, and displays
- Efforts to promote local seafood awareness, marketing and consumption
- On-line/web based information: web page updates; blogs, social media (Facebook and Twitter); electronic pest alerts; developing educational visuals/videos; podcasts
- One-on-one education: Site visits to landowners, fishermen and natural resource professionals; phone, email, video chats and walk-in clients; one-on-one assistance to develop management or business plans
- Public Relations/marketing/communications
- Technical Assistance to state agencies/organizations
- Workshops, conferences, statewide Speaker's Bureau State-wide and multistate (regional) public forums, demonstrations Invited presentations
- Write and respond to news media

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

**Extension**

Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>● Education Class</li> <li>● Workshop</li> <li>● One-on-One Intervention</li> <li>● Demonstrations</li> </ul>	<ul style="list-style-type: none"> <li>● Newsletters</li> <li>● TV Media Programs</li> <li>● Web sites other than eXtension</li> </ul>

**3. Description of targeted audience**

Audiences for **NHAES researchers** include agricultural producers, natural resource managers and consumers, land managers, scientists, undergraduate and K-12 students, public policy makers, regional planners, local communities, and decision-makers concerned with the magnitude of different pollution sources that impact local water quality problems.

Additional target audiences for **Cooperative Extension** include non-industrial private forest owners (NIPF), municipal and other forest landowners, natural resource professionals, communities, volunteers, NH forest-based industries and the public, land owners and recreational users of New Hampshire's lakes, estuaries, rivers, and ocean beaches.

**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 projects.
- Number of university courses in which the 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 research project results have been incorporated.
- Number of one-on-one consultations (woodlot exams, phone calls, emails, office visits, cost share programs, forester referrals, etc.)
- Number of volunteers trained and supported: Coverts, Community Tree Stewards, and other community volunteers such as conservation commissions, etc.
- Number of annual lake reports and coastal reports published on water quality assessments from volunteer monitoring efforts
- Number of towns and conservation groups provided with direct assistance regarding land and water conservation
- People reached through media: press releases, newsletters, radio, TV, web, direct mailing
- Number of postdocs trained in cutting edge research.
- 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 acres of forest management plans meet or exceed NH forest stewardship standards
2	Number of volunteers in conservation work in NH communities as a result of training and continued work by UNHCE primarily in the Coverts and Community Tree Stewards programs
3	Number of people who influence the forest environment in NH with increased working knowledge about forest resource management through workshops, seminars, or educational events annually
4	Number of NH communities engage in natural resource inventories or natural heritage assessments to identify natural assets
5	Number of acres landowners develop conservation easements on in NH acres each year
6	Number of communities to develop action plans that include a variety of approaches for making progress in community-based natural resource protection projects.
7	Number of community decision makers, conservation groups or development professionals who report gaining knowledge about preventing degradation from storm water runoff.
8	Understanding the impact of atmospheric deposition on water quality in order to develop management strategies that stakeholders can use to improve water quality.
9	Address microbial contributions to soil organic matter (SOM) accumulation, and also to the timing and extent of SOM breakdown and N mineralization in various cropping systems.
10	Further understanding of how global change factors impact microbial efficiency, a key determinate of soil C storage and greenhouse gas emissions.
11	Increase understanding of landscape configuration in determining the effectiveness of natural ecosystem services to attenuate N loading from agricultural versus suburban landscapes
12	Develop and refine an integrated system for providing animal bedding using on-farm forest resources; evaluate a experimental static pile aerobic composting system for energy extraction from animal bedding and manure.

**Outcome # 1**

**1. Outcome Target**

Number of acres of forest management plans meet or exceed NH forest stewardship standards

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

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

- 123 - Management and Sustainability of Forest Resources
- 605 - Natural Resource and Environmental Economics

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

- 1862 Extension

**Outcome # 2**

**1. Outcome Target**

Number of volunteers in conservation work in NH communities as a result of training and continued work by UNHCE primarily in the Coverts and Community Tree Stewards programs

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

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

- 112 - Watershed Protection and Management
- 123 - Management and Sustainability of Forest Resources
- 124 - Urban Forestry
- 131 - Alternative Uses of Land

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

- 1862 Extension

**Outcome # 3**

**1. Outcome Target**

Number of people who influence the forest environment in NH with increased working knowledge about forest resource management through workshops, seminars, or educational events annually

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

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



- 123 - Management and Sustainability of Forest Resources
- 124 - Urban Forestry
- 131 - Alternative Uses of Land
- 216 - Integrated Pest Management Systems

#### **4. Associated Institute Type(s)**

- 1862 Extension

#### **Outcome # 4**

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

Number of NH communities engage in natural resource inventories or natural heritage assessments to identify natural assets

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

##### **3. Associated Knowledge Area(s)**

- 112 - Watershed Protection and Management
- 123 - Management and Sustainability of Forest Resources
- 131 - Alternative Uses of Land

##### **4. Associated Institute Type(s)**

- 1862 Extension

#### **Outcome # 5**

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

Number of acres landowners develop conservation easements on in NH acres each year

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

##### **3. Associated Knowledge Area(s)**

- 123 - Management and Sustainability of Forest Resources
- 131 - Alternative Uses of Land

##### **4. Associated Institute Type(s)**

- 1862 Extension

**Outcome # 6**

**1. Outcome Target**

Number of communities to develop action plans that include a variety of approaches for making progress in community-based natural resource protection projects.

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

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

- 123 - Management and Sustainability of Forest Resources
- 131 - Alternative Uses of Land
- 605 - Natural Resource and Environmental Economics

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

- 1862 Extension

**Outcome # 7**

**1. Outcome Target**

Number of community decision makers, conservation groups or development professionals who report gaining knowledge about preventing degradation from storm water runoff.

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

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

- 112 - Watershed Protection and Management
- 403 - Waste Disposal, Recycling, and Reuse

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

- 1862 Extension

**Outcome # 8**

**1. Outcome Target**

Understanding the impact of atmospheric deposition on water quality in order to develop management strategies that stakeholders can use 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 # 9**

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

Address microbial contributions to soil organic matter (SOM) accumulation, and also to the timing and extent of SOM breakdown 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

#### **4. Associated Institute Type(s)**

- 1862 Research

#### **Outcome # 10**

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

Further understanding of how global change factors impact microbial efficiency, a key determinate of soil C storage and greenhouse gas emissions.

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

##### **3. Associated Knowledge Area(s)**

- 102 - Soil, Plant, Water, Nutrient Relationships
- 131 - Alternative Uses of Land

#### **4. Associated Institute Type(s)**

- 1862 Research

#### **Outcome # 11**

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

Increase understanding of landscape configuration in determining the effectiveness of natural ecosystem services to attenuate N loading from agricultural versus suburban landscapes

**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 # 12**

### **1. Outcome Target**

Develop and refine an integrated system for providing animal bedding using on-farm forest resources; evaluate a experimental static pile aerobic composting system for energy extraction from animal bedding and manure.

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

### **3. Associated Knowledge Area(s)**

- 101 - Appraisal of Soil Resources
- 403 - Waste Disposal, Recycling, and Reuse

### **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.)
- Public Policy changes
- Competing Public priorities
- Competing Programmatic Challenges

### **Description**

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

Competing programmatic challenges must be considered in prioritizing resource use. Any changes in this situation, including the availability.

## **V(K). Planned Program - Planned Evaluation Studies**

### **Description of Planned Evaluation Studies**

Evaluation and assessment methods will run the gamut from observation, written evaluations, focus groups, surveys, pre- and post-testing, follow-up communications, public and professional forums.

Research outcomes will be evaluated:

- Through reviews by peer scientists, feedback from diverse information stakeholders, and by success in leveraging NHAES investments with competitive grant funds.
- Through the implementation of research findings by municipal and regional planners in their efforts to mitigate eutrophication of NH's Great Bay.
- Adoption by regional dairy farms of on-farm animal bedding production or aerobic composting methods to reduce costs and decrease the carbon footprint of dairy production.

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

### **Program # 5**

#### **1. Name of the Planned Program**

Supporting a Rural Economy

#### **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.

NHAES research and UNHCE outreach activities support (ornamental) greenhouse and landscape horticulture, which represent the largest single economic sector in NH and are closely tied to our rural areas. The NHAES offers strong support through funded projects as well as providing vital research capacity in the farms and greenhouse facilities that are used for research, extension, and teaching.

#### **NHAES Research** Projects include:

- Developing cost-effective measures to use greenhouses for aquaponic greens productions during the fall and winter off-season. If successful, these systems will allow greenhouse owners to increase revenues during the off-season.
- Developing new procedures to maintain root systems over the winter in northern nursery production systems. These 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 supports several integrated multi-state research projects that are part of this planned program on Rural Economies include

- Using survey and focus groups to understand emerging opportunities and threats to the economic structure of rural communities arising from the potential shifts in local and regional food systems. Identifying and analyzing policies and strategies contributing to the viability and resiliency of communities in responding to economic and policy changes and to natural and human-made shocks. (NE1049)
- Analyzing demographic shifts in rural populations before, during and after the Great Recession (2006-2009); examining links between unemployment and population shifts; and evaluating impacts of socioeconomic changes demand on rural housing. This types\ of information are essential for local, regional and national policy makers.(W3001)
- Improving methods to accurately identify, characterize and communicate with stakeholders groups regarding specific programs or policy formulation. This is an applied research activity that facilitates the work of various local and regional governmental and nongovernmental agencies (WERA1010)

**UNH Cooperative Extension's** community and economic development programming provides communities with the knowledge and tools to strengthen their business base; teaches people the skills to become leaders, engage in local government, and solve community problems and works with small business owners to grow and maintain New Hampshire's farming, fishing and forestry businesses.

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

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

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

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

**V(B). Program Knowledge Area(s)**

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	10%		0%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		15%	
205	Plant Management Systems	5%		15%	
211	Insects, Mites, and Other Arthropods Affecting Plants	5%		0%	
212	Pathogens and Nematodes Affecting Plants	5%		0%	
216	Integrated Pest Management Systems	10%		0%	
403	Waste Disposal, Recycling, and Reuse	0%		15%	
601	Economics of Agricultural Production and Farm Management	20%		15%	
602	Business Management, Finance, and Taxation	10%		0%	
605	Natural Resource and Environmental Economics	15%		0%	
608	Community Resource Planning and Development	20%		10%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%		10%	
901	Program and Project Design, and Statistics	0%		10%	
903	Communication, Education, and Information Delivery	0%		10%	
	<b>Total</b>	100%		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 maintaining our rural character.

Rural New Hampshire communities face many challenges, including changing demographics, shifting economic structures, and societal crises, with unprecedented growth in some regions and decline in others. 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 with 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.

Family businesses are an integral part of the rural community, and maintain a working landscape that provides citizens with superior products as well as connections to farming and "rural" New Hampshire. Each of these program areas address the unique needs of farmers and assist in keeping their operations viable. The number of farms in NH is increasing, but many of the individuals who are starting these operations require basic management education. Small business startups in the natural resources and agricultural industries will require education and support from research and outreach programming in order to successfully add jobs to the NH economy. Community growth on the boundaries of suburban/rural communities places additional strain on land use, particularly with the resurgence of agriculture in New England.

Rural policy-makers and agricultural scientists depend on sample surveys to obtain information on community problems, farming practices, the impacts of policy decisions, and individual opinions. The precision and validity of sample survey estimates, based on small samples of populations to which results are generalized, depend upon controlling multiple sources of error. Among the threats to survey accuracy are errors arising from sampling design and size, coverage, nonresponse and measurement.

Ornamental horticulture is the number one agriculture sector in the state. NHAES funds research and UNHCE funds educational programs on greenhouse crops, and new production systems for shrubs and trees, to address the needs of rural producers and help them to become more competitive. The production component of this sector takes place in rural areas and is an important source of employment.

The priorities of producers (greenhouse and nursery crops) and other green industry businesses are somewhat different from those of the consumer. Producers are focused on crop production and the economic viability of their businesses. However many nurseries and greenhouses are producing crops at less than optimal efficiencies. Labor, raw materials, and energy are becoming increasingly more expensive and/or are harder to source. Owners, operators, and employees often lack sufficient knowledge and skills to maximize productivity while maintaining level or decreased inputs.

## **2. Scope of the Program**

- In-State Extension
- In-State Research
- Multistate Research



- Multistate Extension
- Integrated Research and Extension
- 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 NHAES and Extension research.

Without knowledge of regional differences, policy formation within New Hampshire may be misdirected and cause the state to 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 stakeholders and to design policy changes to improve the welfare of the community. New knowledge about economically, environmentally, and socially sustainable production practices in greenhouses 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 NHAES research in this planned 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.

The goals of Cooperative Extension are

- Farming, fishing, and forestry businesses in New Hampshire are sustained, expanded, or initiated as a result of careful planning, effective marketing, and sound financial and business management practices.
- New Hampshire communities, businesses, organizations, and volunteers work together to steward the state's vast agricultural and natural resources vital to sustaining the state's character and economy.
- New Hampshire communities remain economically vibrant as a result of greater ability to identify competitive advantage and implement effective local and regional economic development strategies.
- Residents of New Hampshire communities are engaged in local decision-making and action, resulting in greater ability to address issues/needs of social, economic, natural and cultural importance.

**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
2015	11.0	0.0	1.9	0.0
2016	11.0	0.0	1.9	0.0

Year	Extension		Research	
	1862	1890	1862	1890
2017	11.0	0.0	1.9	0.0
2018	11.0	0.0	1.9	0.0
2019	11.0	0.0	1.9	0.0

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

**1. Activity for the Program**

**NHAES scientists will:**

- Conduct experiments to develop improved over-wintering techniques for large container grown trees and shrubs that will 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 landscaping products as a result of economic recovery leading to an increased demand for landscaping.
- Evaluate the economic feasibility of using air-to-water heat pumps for climate control inside greenhouses to produce hydroponically-grown salad greens and herbs during the off-season production of ornamentals.
- Document recent demographic trends in both rural and urban areas before and during the Great Recession and compare New Hampshire demographic trends to those in the region and U.S.
- Disseminate this knowledge to local, regional, and national policy makers.
- Collaborate with Extension to identify key issues in local agriculture by using focus groups and surveys.
- Use comparative methods to evaluate errors in survey research from rural communities.
- Apply the results to improve communications for local policy agencies and with the public.

**Cooperative Extension will conduct:**

- Workshops and seminars
- One-on-one business consultations and technical assistance
- Twilight meetings
- Development and dissemination of business resources and publications (web and print)
- Media releases (news and radio)
- Economic Development Technical Assistance
- Economic Development Planning
- Community planning forums/Charettes

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

Extension	
Direct Methods	Indirect Methods

<ul style="list-style-type: none"><li>● Education Class</li><li>● Workshop</li><li>● One-on-One Intervention</li><li>● Demonstrations</li></ul>	<ul style="list-style-type: none"><li>● Newsletters</li><li>● Web sites other than eXtension</li></ul>
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### 3. Description of targeted audience

**NHAES** research and **Cooperative Extension** target audiences include:

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.

Community leaders, municipal board/committees, community volunteers, professional community development practitioners, active community members, municipalities, regional economic development corporations, regional planning commissions, and chambers of commerce.

Farmers, fishermen, food processors, forest products businesses, tourism businesses, industry sectors, potential entrepreneurs, business service providers, greenhouse and landscape professionals.

### 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 people attending workshops/twilight meetings
  - Number of one-on-one consultations with greenhouse growers and landscape professionals
  - Number of communities provided with technical assistance to enhance their decision making with regard to tourism and economic development plans, projects and activities
  - Number of people reached through risk management and farm management workshops
  - Number of people reached through site/farm visits related to farm and forest management
  - Number of Community Profiles (community-level strategic planning program, facilitated by UNHCE professionals)
  - 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 research 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 groups around the state to implement participatory decision-making processes as a result of Civic Participation and Leadership Team activities (i.e. Master Plan Visioning Session, Community Profile Action Planning, strategic planning)
2	Number of communities that build a knowledge base of resources for building civic engagement and leadership
3	Number of communities that work with Extension to implement mechanisms/tools to analyze the current situation and identify emerging issues to be addressed.
4	Number of community leaders who develop a new understanding of the issues facing their community.
5	Number of NH growers who increase their skills, knowledge, and/or awareness of farm management techniques, risk management programs, or marketing practices
6	Number of new businesses started
7	Number of NH growers who formulate plans to guide their crop production pest management, nutrient allocation and business management decisions
8	Number of presentations to civic and government entities to increase knowledge of demographics and migration in the region and nation.
9	Availability of modified production systems for woody nursery crops in northern nurseries.
10	Improved methods to facilitate two-way communications between public and decision makers, and survey instruments associated with natural resource and agriculture management
11	Disseminate results from economic feasibility experiments to heat pumps for greenhouse climate control greens production in Northern New England.
12	Disseminate results of hydroponically-grown, salad green and herbs variety trials.

**Outcome # 1**

**1. Outcome Target**

Number of groups around the state to implement participatory decision-making processes as a result of Civic Participation and Leadership Team activities (i.e. Master Plan Visioning Session, Community Profile Action Planning, strategic planning)

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

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

- 602 - Business Management, Finance, and Taxation
- 608 - Community Resource Planning and Development

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

- 1862 Extension

**Outcome # 2**

**1. Outcome Target**

Number of communities that build a knowledge base of resources for building civic engagement and leadership

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

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

- 602 - Business Management, Finance, and Taxation
- 605 - Natural Resource and Environmental Economics
- 608 - Community Resource Planning and Development

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

- 1862 Extension

**Outcome # 3**

**1. Outcome Target**

Number of communities that work with Extension to implement mechanisms/tools to analyze the current situation and identify emerging issues to be addressed.

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

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

- 605 - Natural Resource and Environmental Economics

- 608 - Community Resource Planning and Development

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

- 1862 Extension

**Outcome # 4**

**1. Outcome Target**

Number of community leaders who develop a new understanding of the issues facing their community.

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

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

- 605 - Natural Resource and Environmental Economics
- 608 - Community Resource Planning and Development

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

- 1862 Extension

**Outcome # 5**

**1. Outcome Target**

Number of NH growers who increase their skills, knowledge, and/or awareness of farm management techniques, risk management programs, or marketing practices

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

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

- 601 - Economics of Agricultural Production and Farm Management
- 602 - Business Management, Finance, and Taxation

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

- 1862 Extension

**Outcome # 6**

**1. Outcome Target**

Number of new businesses started

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

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

- 601 - Economics of Agricultural Production and Farm Management
- 602 - Business Management, Finance, and Taxation
- 605 - Natural Resource and Environmental Economics
- 608 - Community Resource Planning and Development

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

- 1862 Extension

**Outcome # 7**

**1. Outcome Target**

Number of NH growers who formulate plans to guide their crop production pest management, nutrient allocation and business management decisions

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

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

- 102 - Soil, Plant, Water, Nutrient Relationships
- 205 - Plant Management Systems
- 216 - Integrated Pest Management Systems
- 601 - Economics of Agricultural Production and Farm Management
- 602 - Business Management, Finance, and Taxation

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

- 1862 Extension

**Outcome # 8**

**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)**

- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities



#### **4. Associated Institute Type(s)**

- 1862 Research

#### **Outcome # 9**

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

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

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

##### **3. Associated Knowledge Area(s)**

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants

#### **4. Associated Institute Type(s)**

- 1862 Research

#### **Outcome # 10**

##### **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 Action 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 # 11**

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

Disseminate results from economic feasibility experiments to heat pumps for greenhouse climate control greens production in Northern New England.

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

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

- 205 - Plant Management Systems

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

- 1862 Research

**Outcome # 12**

**1. Outcome Target**

Disseminate results of hydroponically-grown, salad green and herbs variety trials.

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

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

- 205 - Plant Management Systems

**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
- Competing Public priorities
- Competing Programmatic Challenges

**Description**

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

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**

The **NHAES** will monitor the outcomes and impacts of research activities in this program area through 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.).
- Evidence of public interest in online resources ("hits").

**Cooperative Extension** will monitor outcomes and impacts of their activities in this planned program through the following ways:

- Baseline and post survey of business planning program participants will be used to assess change in participants' knowledge in each of the three areas (business planning, financial management, and marketing) and to track new business start-ups and employment growth and/or retention.
- Follow-up interview with community and regional economic development leaders who receive programming or technical assistance from UNH Cooperative Extension.
- Results of baseline and post effort surveys will determine effectiveness programming and intent to make changes in practices.

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

**Program # 6**

**1. Name of the Planned Program**

Youth and Family

**2. Brief summary about Planned Program**

The backbone of a vibrant and strong New Hampshire is our youth and families. As the core of our workforce and of our communities, youth and families are the engines of our prosperity and the locus of our well-being. The staff members of the UNHCE Youth & Family Program Team are positioned to provide the research-based education and information necessary to enhance the ability of youth and families (and those who work with them), to make the kind of informed decisions and choices that will strengthen New Hampshire.

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

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

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

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

**V(B). Program Knowledge Area(s)**

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
802	Human Development and Family Well-Being	20%		0%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	20%		0%	
805	Community Institutions, Health, and Social Services	20%		0%	
806	Youth Development	40%		0%	
	<b>Total</b>	100%		0%	

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

**1. Situation and priorities**

Currently the 4-H club and 4-H camping programs reach 28% of the youth served in Cooperative Extension youth programs and has the most community support and visibility of CE youth programs. Other youth are reached through programs offered through school enrichment which include those conducted by Nutrition Connections, Marine Docents and Master Gardeners. 4-H Youth development provides a long term experience with a caring adult in out of school time settings. Youth develop leadership, sense of community and often take ownership for their own direction in learning. Specialized school programs often are more adult directed, intense learning for a shorter period of time. The **4-H Youth Development** team will help provide focused and intentional volunteer training

to help expand and retain both youth and volunteers in the 4-H club and 4-H camping programs thus increasing the % of youth reached in 4-H Youth Development.

In order to be competitive, the 21<sup>st</sup> century NH workforce needs to possess skills in the areas of science, technologically, engineering, and mathematics. Our schools often struggle to provide both the informal and hands-on place-based science learning opportunities that provide students with the tools and confidence to pursue work or further studies in science.

NH Youth Risk Behavior Surveys, Carsey Institute research, and other recent surveys all indicate that our young people face significant challenges finding outlets and environments where they feel valued and supported. While well-intended educators work with constructive outcomes in mind, they need research-based resources (provided by the **Positive Learning Environments for Youth** team), proven methods and effective collaborations in order to partner with youth effectively.

## **2. Scope of the Program**

- In-State Extension
- Multistate Extension

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

### **1. Assumptions made for the Program**

4-H YD is a well respected and effective youth development program in NH.

A successful 4-H YD program is dependent on adequate number of competent volunteers.

Youth and family staff have the ability to recognize and understand the needs of individuals in communities, and to facilitate educational opportunities in respond to those needs.

Partnerships between University System of New Hampshire (USNH) and UNHCE youth and family staff can provide two-way communications for youth, families, faculty and community partners to foster lifelong learning.

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

Improve number and quality of opportunities in NH that incorporate research-based "essential elements" of Positive Youth Development that are necessary to support our youth as they develop into contributing citizens.

Increase the number of youth in NH who are ready to engage confidently in science-related projects, studies and careers; and increase the ability of non-formal and volunteer science educators to engage effectively with youth in this area.

Improve NH's capacity to support vulnerable families and youth, through the increased effectiveness of community collaborations and social/human service organizations; and the life skill development of inmates, military youth, and More Than Wheels participants.

## **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
2015	22.0	0.0	0.0	0.0
2016	20.0	0.0	0.0	0.0
2017	20.0	0.0	0.0	0.0
2018	20.0	0.0	0.0	0.0
2019	20.0	0.0	0.0	0.0

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

**1. Activity for the Program**

- 4-H Youth Development staff and volunteer training (both in person and on-line)
- 4-H Youth Development projects, clubs, events, and camp (including NH Teen Council & Conference, National Congress & Conference, Barry Conservation Camp, healthy living and science projects)
  - 4-H Youth Development staff and volunteer training (both in person and on-line)
- Afterschool Staff trainings - including N.H. Afterschool Professional Development Career System and Certification Process
  - Marine Docent educational work with schools and groups
  - Science Literacy statewide community of practice for agencies/organizations involved in this work
  - Seacoast SeaPerch

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

**Extension**

Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <li>• Education Class</li> <li>• Workshop</li> <li>• One-on-One Intervention</li> <li>• Demonstrations</li> </ul>	<ul style="list-style-type: none"> <li>• Newsletters</li> </ul>

**3. Description of targeted audience**

Youth, ages 0-18, 4-H members and volunteers, limited resource families and children, after school program staff, health practitioners

## 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 volunteers supported and recognized
  - Number of youth enrolled in 4-H as a 4-H club, after school or special interest group member
  - Number of youth attending Barry Conservation Camp
  - Number of adults participating in financial literacy programs
- 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 enrolled 4-H members participating in citizenship projects/events who show an increase in their knowledge about citizenship and an increase in their actual citizenship skills
2	Number of 4-H Volunteers, 4-H Staff, Afterschool Staff and other Youth Development practitioners receiving training and/or technical assistance who report providing environments for youth with essential positive youth development elements present (e.g., sense of belonging, mastery, independence, & generosity)
3	Number of enrolled 4-H members participating in STEM projects/events who show an increase in their knowledge about STEM and an increase their STEM skills
4	Number of program participants who document an increase in their financial literacy
5	Number of youth taking on leadership roles



**Outcome # 1**

**1. Outcome Target**

Number of enrolled 4-H members participating in citizenship projects/events who show an increase in their knowledge about citizenship and an increase in their actual citizenship skills

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

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

- 805 - Community Institutions, Health, and Social Services
- 806 - Youth Development

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

- 1862 Extension

**Outcome # 2**

**1. Outcome Target**

Number of 4-H Volunteers, 4-H Staff, Afterschool Staff and other Youth Development practitioners receiving training and/or technical assistance who report providing environments for youth with essential positive youth development elements present (e.g., sense of belonging, mastery, independence, & generosity)

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

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

- 802 - Human Development and Family Well-Being
- 805 - Community Institutions, Health, and Social Services

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

- 1862 Extension

**Outcome # 3**

**1. Outcome Target**

Number of enrolled 4-H members participating in STEM projects/events who show an increase in their knowledge about STEM and an increase their STEM skills

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

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

- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities

- 806 - Youth Development

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

- 1862 Extension

**Outcome # 4**

**1. Outcome Target**

Number of program participants who document an increase in their financial literacy

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

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

- 802 - Human Development and Family Well-Being
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities

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

- 1862 Extension

**Outcome # 5**

**1. Outcome Target**

Number of youth taking on leadership roles

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

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

- 806 - Youth Development

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

- 1862 Extension

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

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

- Economy
- Appropriations changes
- Competing Public priorities

- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

### **Description**

Changes in funding and resource availability for the activities, and in policies or regulations related to Research and Extension using human subjects, would compromise the feasibility of completing the objectives. The current Federal and State budgetary limitations, combined with recent State reductions in capacity funds (2012), will impact the direct support of personnel or facilities and limit our abilities to complete the proposed NHAES and Extension activities.

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.

More diverse family structures. Increase in number of NH families living in poverty.

NH communities lack resources for youth opportunities, particularly in rural areas

Increasing need for out-of-school time activities promoting positive youth development for NH youth, especially teens.

## **V(K). Planned Program - Planned Evaluation Studies**

### **Description of Planned Evaluation Studies**

- Post participation survey using 4-H Common Measures Survey - Universal items and Science Literacy items for grades 4-7 or grades 8-12
- Post participation survey using Barry Camp Questionnaire
- Periodic survey utilizing CYFER common measure: Program Quality Instrument for Adult Staff & Volunteers