

2008 University of New Hampshire Research Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

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

During FY2008, 66 faculty members along with multiple UNH and outside collaborators and technical support persons, and 219 students (79 graduate, 107 undergraduate, and 33 high school) directly participated in 62 research projects supported by the NHAES. The projects undertook basic and applied research in 9 Planned Program Areas that included Agriculture and Food Biosecurity (1 project); Agricultural Systems (1 project); Animals and Animal Products (9 projects); Biotechnology & Genomics (13 projects); Economics & Commerce (3 projects); Food, Nutrition & Health (10 projects); Natural Resources & Environment (13 Projects); Pest Management (1 project); and Plant & Plant Products (8 projects). Overall, the research projects advanced knowledge in a wide variety of fields. New information discovered was disseminated through 59 peer-reviewed publications in scientific journals, 3 book chapters, 17 graduate student theses and dissertations, 19 reviewed publications, and numerous extension and popular press articles and publications. Research results and their implications were presented at scores of regional, national and international scientific meeting and workshops, websites, producer workshops and meetings, legislative hearings, and other public venues.

Total Actual Amount of professional FTEs/SYs for this State

| Year:2008 | Extension | | Research | |
|---------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 12.9 | 0.0 |
| Actual | 0.0 | 0.0 | 13.4 | 0.0 |

II. Merit Review Process**1. The Merit Review Process that was Employed for this year**

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

2. Brief Explanation

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

III. Stakeholder Input**1. Actions taken to seek stakeholder input that encouraged their participation**

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of selected individuals from the general public
- Other (Reviews from Submitted manuscripts and research proposals)

Brief Explanation

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

2(A). A brief statement of the process that was 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
- Open Listening Sessions
- Use Surveys
- Other (Steering Committees)

Brief Explanation

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

2(B). A brief statement of the process that was 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
- Meeting with traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Meeting specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

Brief Explanation

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

3. A statement of how the input was considered

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

Brief Explanation

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

Brief Explanation of what you learned from your Stakeholders

We encountered very broad and strongly supportive input concerning our move towards a sustainable agricultural systems focus, local food systems, and nutrition and health aspects of agricultural products. This includes creating a new research facility that operates as a diversified organic farm, and having certified organic fields to grow feed for our dairy and equine facilities. Some traditional stakeholders expressed concern that this meant we are moving away from supporting traditional activities, and we continue to assure them that we fully intend to provide broad support for all relevant agricultural enterprises, within our abilities. We maintain communication with the director of the NH Division of Agriculture, Markets and Food, who tells us that our efforts to revitalize agricultural research and teaching, including the sustainability focus, enjoy strong and increasing stakeholder support.

IV. Expenditure Summary

| 1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS) | | | |
|--|-----------------------|-----------------|--------------------|
| Extension | | Research | |
| Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| 0 | 0 | 1501530 | 0 |

| 2. Totaled Actual dollars from Planned Programs Inputs | | | | |
|---|--------------------------------|-----------------------|-----------------|--------------------|
| Extension | | | Research | |
| | Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| Actual Formula | 0 | 0 | 2787783 | 0 |
| Actual Matching | 0 | 0 | 2024082 | 0 |
| Actual All Other | 0 | 0 | 187066 | 0 |
| Total Actual Expended | 0 | 0 | 4998931 | 0 |

| 3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous years | | | | |
|--|---|---|--------|---|
| Carryover | 0 | 0 | 913334 | 0 |

V. Planned Program Table of Content

| S. NO. | PROGRAM NAME |
|---------------|---------------------------------|
| 1 | Agricultural & Food Biosecurity |
| 2 | Agricultural Systems |
| 3 | Animals & Animal Products |
| 4 | Biotechnology & Genomics |
| 5 | Economics & Commerce |
| 6 | Food, Nutrition & Health |
| 7 | Natural Resources & Environment |
| 8 | Pest Management |
| 9 | Plants & Plant Products |

Program #1**V(A). Planned Program (Summary)****1. Name of the Planned Program**

Agricultural & Food Biosecurity

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|--------------------------------------|-----------------|-----------------|----------------|----------------|
| 136 | Conservation of Biological Diversity | | | 50% | |
| 213 | Weeds Affecting Plants | | | 50% | |
| | Total | | | 100% | |

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

| Year: 2008 | Extension | | Research | |
|---------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 0.3 | 0.0 |
| Actual | 0.0 | 0.0 | 0.3 | 0.0 |

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

| Extension | | Research | |
|---------------------|----------------|----------------|----------------|
| Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| 0 | 0 | 23483 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 23483 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 19897 | 0 |

V(D). Planned Program (Activity)**1. Brief description of the Activity**

Molecular markers are being developed to resolve population structure of the invasive red algae *Neosiphonia harveyi*. These markers will be used to survey new and extant populations of the alga from Long Island through the Gulf of Maine. The genotypes of these populations will be compared to extant populations in Europe and Ireland and to populations in the Sea of Japan to determine whether there have been one or multiple introductions of the invasive alga in the Gulf of Maine, relative to the recent explosive expansion of this alga. Research during this initial year was focused on the putative vector *Codium Fragile* in the Gulf of Maine. Many of the collected samples were found to contain samples of *N. harveyi*. A collection database was established for current and future applications.

2. Brief description of the target audience

Scientists in this and related disciplines, K-12 students, undergraduate and graduate university students, ecosystem managers, fisheries cooperatives, and the public.

V(E). Planned Program (Outputs)

1. Standard output measures

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|-------------|-----------------------------------|-------------------------------------|----------------------------------|------------------------------------|
| Year | Target | Target | Target | Target |
| Plan | 50 | 20 | 0 | 50 |
| 2008 | 0 | 30 | 0 | 60 |

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

| Year | Target |
|--------------|---------------|
| Plan: | 0 |
| 2008 : | 0 |

Patents listed

None

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| | Extension | Research | Total |
|-------------|------------------|-----------------|--------------|
| Plan | 0 | 0 | |
| 2008 | 0 | 0 | 0 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer Review Publications

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 1 | 0 |

Output #2

Output Measure

- Non peer reviewed publications including abstracts

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 2 | 0 |

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

| O No. | OUTCOME NAME |
|--------------|--|
| 1 | Members of the general public identifying the algal in new locations along the Gulf of Maine |
| 2 | Number of citations from publications |

Outcome #1

1. Outcome Measures

Members of the general public identifying the algal in new locations along the Gulf of Maine
Not reporting on this Outcome for this Annual Report

Outcome #2

1. Outcome Measures

Number of citations from publications
Not reporting on this Outcome for this Annual Report

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Appropriations changes

Brief Explanation

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Before-After (before and after program)
- During (during program)

Evaluation Results

Key Items of Evaluation

Program #2

V(A). Planned Program (Summary)

1. Name of the Planned Program

Agricultural Systems

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% | |
| 131 | Alternative Uses of Land | | | 10% | |
| 205 | Plant Management Systems | | | 60% | |
| 307 | Animal Management Systems | | | 20% | |
| | Total | | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

| Year: 2008 | Extension | | Research | |
|---------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 0.3 | 0.0 |
| Actual | 0.0 | 0.0 | 0.3 | 0.0 |

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

| Extension | | Research | |
|---------------------|----------------|----------------|----------------|
| Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| 0 | 0 | 43996 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 43996 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 2732 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

The potential for agricultural sustainability and food self-sufficiency and security in northern and central New England was examined with particular emphasis on pasture and grazing history potential, and the integration of plant and animal agriculture to achieve agricultural/farm sustainability. The potential current and future regional food sufficiency was addressed through philosophical approaches to grass-based agricultural systems. A soils map for grazing was produced, and attention given to the potential of the region's land grant universities and experiment stations to provide for regional food self-sufficiency.

2. Brief description of the target audience

Conventional and organic farmers and future farmers in the region, and indirectly, consumers of food in the region.

V(E). Planned Program (Outputs)

1. Standard output measures

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|-------------|-----------------------------------|-------------------------------------|----------------------------------|------------------------------------|
| Year | Target | Target | Target | Target |
| Plan | 800 | 9200 | 200 | 0 |
| 2008 | 300 | 1200 | 75 | 125 |

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

| Year | Target |
|--------------|---------------|
| Plan: | 0 |
| 2008 : | 0 |

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| | Extension | Research | Total |
|-------------|------------------|-----------------|--------------|
| Plan | 0 | 0 | |
| 2008 | 0 | 0 | 0 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer Reviewed Publications

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 0 | 0 |

Output #2

Output Measure

- Chapters in Books

Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Author of Book or Editor

Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Non-peer reviewed publications including abstracts

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 12 | 1 |

Output #5

Output Measure

- Author of Experiment Station publication

| Year | Target | Actual |
|-------------|-------------------|---------------|
| 2008 | {No Data Entered} | 1 |

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

| O No. | OUTCOME NAME |
|--------------|---|
| 1 | Change in farming practice |
| 2 | Change in food consumption patterns |
| 3 | Change in public policy |
| 4 | Regulators increase knowledge |
| 5 | Change in percent of agricultural land |
| 6 | Change in on-farm biodiversity |
| 7 | Producers use soil testing. |
| 8 | Change in support for small-scale farms |
| 9 | Change in farmer income |

Outcome #1

1. Outcome Measures

Change in farming practice

Not reporting on this Outcome for this Annual Report

Outcome #2

1. Outcome Measures

Change in food consumption patterns

Not reporting on this Outcome for this Annual Report

Outcome #3

1. Outcome Measures

Change in public policy

Not reporting on this Outcome for this Annual Report

Outcome #4

1. Outcome Measures

Regulators increase knowledge

Not reporting on this Outcome for this Annual Report

Outcome #5

1. Outcome Measures

Change in percent of agricultural land

Not reporting on this Outcome for this Annual Report

Outcome #6

1. Outcome Measures

Change in on-farm biodiversity

Not reporting on this Outcome for this Annual Report

Outcome #7

1. Outcome Measures

Producers use soil testing.

Not reporting on this Outcome for this Annual Report

Outcome #8

1. Outcome Measures

Change in support for small-scale farms

Not reporting on this Outcome for this Annual Report

Outcome #9

1. Outcome Measures

Change in farmer income

Not reporting on this Outcome for this Annual Report

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.
- Comparison between locales where the program operates and sites without program intervention

Evaluation Results

Key Items of Evaluation

Program #3**V(A). Planned Program (Summary)****1. Name of the Planned Program**

Animals & Animal Products

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|--|-----------------|-----------------|----------------|----------------|
| 135 | Aquatic and Terrestrial Wildlife | | | 25% | |
| 301 | Reproductive Performance of Animals | | | 25% | |
| 302 | Nutrient Utilization in Animals | | | 5% | |
| 305 | Animal Physiological Processes | | | 10% | |
| 307 | Animal Management Systems | | | 5% | |
| 308 | Improved Animal Products (Before Harvest) | | | 10% | |
| 311 | Animal Diseases | | | 10% | |
| 702 | Requirements and Function of Nutrients and Other Food Components | | | 10% | |
| | Total | | | 100% | |

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

| Year: 2008 | Extension | | Research | |
|---------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 1.5 | 0.0 |
| Actual | 0.0 | 0.0 | 2.8 | 0.0 |

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

| Extension | | Research | |
|---------------------|----------------|----------------|----------------|
| Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| 0 | 0 | 785156 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 458581 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 0 | 0 |

V(D). Planned Program (Activity)**1. Brief description of the Activity**

Growth studies were continued comparing formulated diets that varied in protein and energy levels for juvenile sea urchins for outplanting and grow out. Recruitment studies were continued in the Gulf of Maine to evaluate reestablishment of adult populations. The relationships between water temperature, light level, and lobster movements was investigated in the laboratory and in the Great Bay estuary ecosystem. Genes controlling genetic control of poultry immune responses were evaluate through development of congenic lines to achieve an estimated 99.9 percent genetic uniformity. The role of oocyte quality, follicular/luteal function, and metabolic demands of animal production alter key hormonal and cellular signals for oocyte competence, fertilization, and embryo survival in early pregnancy were evaluated through in vivo and in vitro investigations. Physiological attributes of the corpus luteum of dairy cows, through focus on the ovarian vasculature, were evaluated to improve fertility in ruminants. In vitro methods that could be used by commercial feed testing laboratories to estimate the intestinal availability of amino acids in the rumen undegraded protein fraction of feeds, with particular focus on lysine, one of the two most limiting amino acids in dairy cow nutrition. The comparative efficacy of two forms of methionine supplements for lactating dairy cows was evaluated. Supplementing dairy cows with soybean while grazing was evaluated as a means to increase milk yield. Efficacy of adding sodium bicarbonate to milk and colostrums replacer products in an attempt to improve blood concentration of IgC was evaluated in dairy calves.

2. Brief description of the target audience

The target audience includes producers, commercial and private fisheries, conservation organizations, government officials and regulators, consultants, commercial feed companies, K-12 and university students, scientists and extension educators.

V(E). Planned Program (Outputs)

1. Standard output measures

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|------|---------------------------|-----------------------------|--------------------------|----------------------------|
| Year | Target | Target | Target | Target |
| Plan | 700 | 4500 | 50 | 25 |
| 2008 | 550 | 4500 | 160 | 40 |

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

| Year | Target |
|--------|--------|
| Plan: | 0 |
| 2008 : | 0 |

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| | Extension | Research | Total |
|------|-----------|----------|-------|
| Plan | 0 | 11 | |
| 2008 | 0 | 5 | 5 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer Reviewed Publications

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 11 | 0 |

Output #2

Output Measure

- Chapters in books

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 0 | 0 |

Output #3

Output Measure

- Non peer reviewed publications including abstracts

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 8 | 4 |

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

| O No. | OUTCOME NAME |
|--------------|--|
| 1 | Number of published Publications |
| 2 | Citations |
| 3 | Number of submissions of grant proposals |
| 4 | Average Impact factor of publications |
| 5 | Number of Aquaculturists learning ovulation induction methods |
| 6 | Number of youths and adults attending educational classes/workshops |
| 7 | Number of specific antibodies generated |
| 8 | Number of oral/poster presentations at meetings |
| 9 | Number of graduate students trained |
| 10 | Number of educational workshops held |
| 11 | Number of fishermen who have been trained in the treatment of leukemia |
| 12 | Collaborations in sea urchin hatchery development |
| 13 | Collaborations on juvenile grow out |
| 14 | Participation in Fisheries Management Council |
| 15 | Increased understanding and success for aquaculture methods. |
| 16 | Physiological factors that influence reproduction in ruminants. |
| 17 | Knowledge of dairy feeds and supplementation. |
| 18 | Improved colostrum replacer for dairy calf immunoglobulins. |
| 19 | Improved feeding profitability for dairy herds. |
| 20 | Better shelf life of dairy feed inoculants. |
| 21 | Decreased infertility in dairy cows. |

Outcome #1

1. Outcome Measures

Number of published Publications

Not reporting on this Outcome for this Annual Report

Outcome #2

1. Outcome Measures

Citations

Not reporting on this Outcome for this Annual Report

Outcome #3

1. Outcome Measures

Number of submissions of grant proposals

Not reporting on this Outcome for this Annual Report

Outcome #4

1. Outcome Measures

Average Impact factor of publications

Not reporting on this Outcome for this Annual Report

Outcome #5

1. Outcome Measures

Number of Aquaculturists learning ovulation induction methods

Not reporting on this Outcome for this Annual Report

Outcome #6

1. Outcome Measures

Number of youths and adults attending educational classes/workshops

Not reporting on this Outcome for this Annual Report

Outcome #7

1. Outcome Measures

Number of specific antibodies generated

Not reporting on this Outcome for this Annual Report

Outcome #8

1. Outcome Measures

Number of oral/poster presentations at meetings

Not reporting on this Outcome for this Annual Report

Outcome #9

1. Outcome Measures

Number of graduate students trained

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 5 | 1 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 308 | Improved Animal Products (Before Harvest) |
| 135 | Aquatic and Terrestrial Wildlife |
| 311 | Animal Diseases |
| 302 | Nutrient Utilization in Animals |
| 702 | Requirements and Function of Nutrients and Other Food Components |
| 305 | Animal Physiological Processes |
| 301 | Reproductive Performance of Animals |

Outcome #10**1. Outcome Measures**

Number of educational workshops held

*Not reporting on this Outcome for this Annual Report***Outcome #11****1. Outcome Measures**

Number of fishermen who have been trained in the treatment of leukemia

*Not reporting on this Outcome for this Annual Report***Outcome #12****1. Outcome Measures**

Collaborations in sea urchin hatchery development

*Not reporting on this Outcome for this Annual Report***Outcome #13****1. Outcome Measures**

Collaborations on juvenile grow out

*Not reporting on this Outcome for this Annual Report***Outcome #14****1. Outcome Measures**

Participation in Fisheries Management Council

Not reporting on this Outcome for this Annual Report

Outcome #15

1. Outcome Measures

Increased understanding and success for aquaculture methods.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|-------------|----------------------------|---------------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Increased efficiency and effectiveness of managed aquaculture endeavors are critical to provision of healthy dietary protein. Current efforts are constrained by incomplete understanding of cultural methods and target animal behavior that influences their successful management.

What has been done

Growth studies were continued comparing formulated diets that varied in protein and energy levels for juvenile sea urchins for outplanting and grow out. Recruitment studies were continued in the Gulf of Maine to evaluate reestablishment of adult populations. The relationships between water temperature, light level, and lobster movements was investigated in the laboratory and in the Great Bay estuary ecosystem.

Results

Only limited reestablishment of adult sea urchins was observed, which was not adequate a grow out fishery. Combining caging, which increases initial settlement of natural stocks, with refuges for early growth show promise for increasing natural stocks and complementing the output from hatcheries. A new technique that utilizes accelerometers attached to the dorsal carapace was developed to measure the activity of free moving lobsters, and aids in evaluating factors that influence seasonal movements. Analogues of gonadotropin releasing hormone administered as slow-release implants were highly effective in inducing ovulation and spermiation in Atlantic cod, and were significantly more effective than single injections of chorionic gonadotropin.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|---|
| 305 | Animal Physiological Processes |
| 307 | Animal Management Systems |
| 135 | Aquatic and Terrestrial Wildlife |
| 308 | Improved Animal Products (Before Harvest) |

Outcome #16

1. Outcome Measures

Physiological factors that influence reproduction in ruminants.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Successfully and efficient reproduction in reinants is critical to commercial operations which supply food and fiber, including meat and dairy products.

What has been done

The role of oocyte quality, follicular/luteal function, and metabolic demands of animal production alter key hormonal and cellular signals for oocyte competence, fertilization, and embryo survival in early pregnancy were evaluated through in vivo and in vitro investigations. Physiological attributes of the corpus luteum of dairy cows, through focus on the ovarian vasculature, were evaluated to improve fertility in ruminants.

Results

Research improved understanding of how oocyte quality, follicular/luteal function, and metabolic demands of animal production alter key hormonal and cellular signals for oocyte competence, fertilization, and embryo survival in early pregnancy. This knowledge can be used to prevent embryonic loss and provide therapeutic approaches to treat infertility.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 307 | Animal Management Systems |
| 305 | Animal Physiological Processes |
| 308 | Improved Animal Products (Before Harvest) |
| 301 | Reproductive Performance of Animals |

Outcome #17**1. Outcome Measures**

Knowledge of dairy feeds and supplementation.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

A substantial expense in dairy production is cost effective feeding and supplementation to maximize herd health and productivity. Increased knowledge of appropriate methods, materials, and supplementation is critical to producers and consumers of resulting products and services.

What has been done

In vitro methods that could be used by commercial feed testing laboratories to estimate the intestinal availability of amino acids in the rumen undegraded protein fraction of feeds, with particular focus on lysine, one of the two most limiting amino acids in dairy cow nutrition. The comparative efficacy of two forms of methionine supplements for lactating dairy cows was evaluated. Supplementing dairy cows with soybean while grazing was evaluated as a means to increase milk yield. Efficacy of adding sodium bicarbonate to milk and colostrums replacer products in an attempt to improve blood concentration of IgC was evaluated in dairy calves.

Results

Digestibility of amino acids in feed protein was similar to that for RUP-amino acids in soybean meal and fishmeal, but their digestibility in intact distiller's grains was lower than for RUP in these grains. This allows adoption of amino acid digestibility estimates already reported for intact feeds in the swine and poultry literature for these feeds, by eliminating the ruminal incubation step in determining intestinal digestibility of these nutrients. An apparent advantage of a methionine supplement on rumen fermentation was identified, which results on more milk in dairy cows. This assists nutritionists in evaluating the relative amounts to prescribe in feeds. Feeding cows roasted soybeans while receiving 20 pounds of corn silage and grazing increased milk production, with feeding 6 pounds per day being most cost effective. Adding a silage inoculant designed to be added to wet distillers grains at the rate of 1 pound per ton of wet grains increased its shelf life by about one week. Adding 19.5 grams of sodium carbonate to colostrum replacer fed to neonatal dairy calves increased blood concentration of IgC by about 25 percent, an outcome that will assist companies, consultants and producers. An apparent advantage of a methionine supplement on rumen fermentation was identified, which results on more milk in dairy cows. This assists nutritionists in evaluating the relative amounts to prescribe in feeds. Feeding cows roasted soybeans while receiving 20 pounds of corn silage and grazing increased milk production, with feeding 6 pounds per day being most cost effective. Adding a silage inoculant designed to be added to wet distillers grains at the rate of 1 pound per ton of wet grains increased its shelf life by about one week. Adding 19.5 grams of sodium carbonate to colostrum replacer fed to neonatal dairy calves increased blood concentration of IgC by about 25 percent, an outcome that will assist companies, consultants and producers.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 702 | Requirements and Function of Nutrients and Other Food Components |
| 307 | Animal Management Systems |
| 302 | Nutrient Utilization in Animals |
| 305 | Animal Physiological Processes |
| 311 | Animal Diseases |
| 308 | Improved Animal Products (Before Harvest) |

Outcome #18

1. Outcome Measures

Improved colostrum replacer for dairy calf immunoglobulins.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Calves are born without immunity to disease. They must receive immunoglobulins, specifically immunoglobulin G, from their dam's colostrum (first milk). Utilizing colostrum replacer (dried colostrum) has become important because some debilitating diseases, such as Johne's, can be spread from the cow to the calf. Any means that can be developed to increase the immunity of such dairy calves is critical to their health and overall production potential.

What has been done

Adding 29.25 g sodium bicarbonate to colostrum replacer within the first 24 h of life increased blood IgG concentrations diagnostic of improved immunity by 25 percent over that of calves receiving colostrum replacer alone.

Results

Milk and colostrum replacer companies will likely add sodium bicarbonate to their colostrum replacers in an attempt to improve blood concentration of IgG in the neonate.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 307 | Animal Management Systems |
| 308 | Improved Animal Products (Before Harvest) |
| 702 | Requirements and Function of Nutrients and Other Food Components |
| 302 | Nutrient Utilization in Animals |
| 305 | Animal Physiological Processes |

Outcome #19

1. Outcome Measures

Improved feeding profitability for dairy herds.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Development of feeding guidelines to increase milk production in an economic manner is crucial to dairy profitability.

What has been done

Feeding dairy cows roasted soybeans while receiving 20 pounds of corn silage and grazing forage resulted in increased milk production. Feeding 4 pounds per day was found to be cost effective.

Results

Dairy farmers will therefore increase milk production and profitability by supplementing roasted soybeans to grazing cows.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 308 | Improved Animal Products (Before Harvest) |
| 307 | Animal Management Systems |
| 702 | Requirements and Function of Nutrients and Other Food Components |
| 302 | Nutrient Utilization in Animals |

Outcome #20

1. Outcome Measures

Better shelf life of dairy feed inoculants.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The relatively small scale of many New England dairies prevents their ability to economically utilize some nutrient sources that must be purchased in bulk.

What has been done

Our research found that including a silage inoculant designed to be added to wet distillers grains at the rate of one pound per ton increased shelf life by approximately one week.

Results

Typically wet brewers grains have a shelf life of five to seven days. Doubling the shelf life means that purchasing bulk amounts of wet brewers grains is more feasible, as previously many small dairy producers would not have been able to feed sufficient amounts before spoilage.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 702 | Requirements and Function of Nutrients and Other Food Components |
| 307 | Animal Management Systems |
| 302 | Nutrient Utilization in Animals |

Outcome #21**1. Outcome Measures**

Decreased infertility in dairy cows.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Animal producers, nutritionists, veterinarians, educators, and extension staff desire new approaches to improve reproductive efficiency in dairy cattle and thereby increase revenue. Our research in association with an AES multistate project provided core information concerning the synchronization of estrus in cattle prior to breeding. Economic pressure to increase milk yield in the dairy industry has compromised fertility in the dairy cow. Currently, pregnancy rate in lactating cows on the average US dairy farm is at an all-time low of 20-30 percent. Cows with irregular ovarian cycles, often attributed to ovulation or luteal failure, are part of the problem. Infertility costs dairy producers \$2 to \$4 per cow per day and accounts for the majority of dairy cows culled each year.

What has been done

We determined that synchronization must be managed not only to influence the occurrence of estrus and ovulation, but also to ensure the ovulation of a growing dominant follicle, so that fertility at synchronized estrus will be high.

Results

These results will help diminish the overall cost of infertility to dairy producers, which currently exceeds \$350 million annually. Contributions of scientific publications from this work have also spurred further research at other research and industry locations, benefitting the dairy industry overall.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|-------------------------------------|
| 305 | Animal Physiological Processes |
| 301 | Reproductive Performance of Animals |
| 307 | Animal Management Systems |

V(H). Planned Program (External Factors)**External factors which affected outcomes**

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

Brief Explanation**V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

-

Evaluation Results**Key Items of Evaluation**

Program #4

V(A). Planned Program (Summary)

1. Name of the Planned Program

Biotechnology & Genomics

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|--------------|---|-----------------|-----------------|----------------|----------------|
| 135 | Aquatic and Terrestrial Wildlife | | | 10% | |
| 136 | Conservation of Biological Diversity | | | 5% | |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms | | | 10% | |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants | | | 10% | |
| 206 | Basic Plant Biology | | | 10% | |
| 212 | Pathogens and Nematodes Affecting Plants | | | 7% | |
| 303 | Genetic Improvement of Animals | | | 10% | |
| 304 | Animal Genome | | | 10% | |
| 305 | Animal Physiological Processes | | | 10% | |
| 511 | New and Improved Non-Food Products and Processes | | | 10% | |
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources. | | | 8% | |
| Total | | | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

| Year: 2008 | Extension | | Research | |
|---------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 2.1 | 0.0 |
| Actual | 0.0 | 0.0 | 2.1 | 0.0 |

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

| Extension | | Research | |
|---------------------|----------------|----------------|----------------|
| Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| 0 | 0 | 590964 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 291297 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 0 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

Regulation of polyamine metabolism in poplar cells was evaluated in response to stressors. A summer workshop dealing with agricultural biotechnology was conducted for 32 inner-city high school students from underrepresented and minority groups. The role of PAB1 in the control of mRNA degradation was investigated through proteomic analyses. Research was conducted to determine the biochemical basis for the differences between rod and cone photoreceptors in the vertebrate retina. 57 germplasm accessions of wild and cultivated *Fragaria* were screened for resistance versus susceptibility to the fungal disease *Verticillium*. A novel approach to strawberry production was evaluated to extend season of availability and increase profitability. Responses of plants to salinity through mutations in protein phosphatase genes were evaluated to enhance production potential under saline conditions. Bacterial interactions affecting the association with an important nematode were evaluated to increase understanding of symbioses and parasitic relationships important in agricultural soils. Molecular markers are being developed to resolve population structure of the invasive red alga *Neosiphonia harveyi*, and will be used to survey new and extant populations of the alga from Long Island through the Gulf of Maine.

2. Brief description of the target audience

The target audience includes K-12, undergraduate and graduate students, scientists, educators, laypersons, pharmaceutical companies, plant and animal breeders and producers, and agricultural product consumers.

V(E). Planned Program (Outputs)

1. Standard output measures

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|-------------|-----------------------------------|-------------------------------------|----------------------------------|------------------------------------|
| Year | Target | Target | Target | Target |
| Plan | 2100 | 4550 | 205 | 150 |
| 2008 | 2300 | 4900 | 250 | 125 |

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

| Year | Target |
|--------------|---------------|
| Plan: | 3 |
| 2008 : | 0 |

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| | Extension | Research | Total |
|-------------|------------------|-----------------|--------------|
| Plan | 0 | 21 | |
| 2008 | 0 | 16 | 15 |

V(F). State Defined Outputs

Output Target

Output #1**Output Measure**

- Peer-reviewed manuscripts

| Year | Target | Actual |
|------|--------|--------|
| 2008 | 21 | 16 |

Output #2**Output Measure**

- Chapters in Books

| Year | Target | Actual |
|------|--------|--------|
| 2008 | 2 | 1 |

Output #3**Output Measure**

- Author of book or editor

| Year | Target | Actual |
|------|--------|--------|
| 2008 | 0 | 0 |

Output #4**Output Measure**

- Non peer reviewed publications including abstracts

Not reporting on this Output for this Annual Report

Output #5**Output Measure**

- Identity and submission of cDNA, ESTs, proteins, genes, RNA to GenBank

Not reporting on this Output for this Annual Report

Output #6**Output Measure**

- Reviewed publications including theses and abstracts

| Year | Target | Actual |
|------|-------------------|--------|
| 2008 | {No Data Entered} | 14 |

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

| O No. | OUTCOME NAME |
|--------------|--|
| 1 | Peer Reviewed Publications |
| 2 | Public understanding of Microbial opportunists |
| 3 | Number of farmers considering biological control |
| 4 | Number of Readers of Peer Reviewed Publications |
| 5 | Number in audience of class or scientific meeting |
| 6 | Number of Graduate students trained in laboratories |
| 7 | Number of undergraduate students trained in laboratory; involved in investigations |
| 8 | Number of postdoctoral fellows trained |
| 9 | Number of users of released DNA sequences, germplasm; ESTs, proteins |
| 10 | Change in policy |
| 11 | Number of grant submissions |
| 12 | Number of meetings/workshops attended |
| 13 | Increased knowledge and tools for practical use |
| 14 | Increased exposure and training of youth and underrepresented groups. |
| 15 | New molecular approaches for specialty crop breeding. |
| 16 | Develop superior varieties of locally-adapted specialty crops. |
| 17 | Improved knowledge of macular function in humans and animals. |

Outcome #1**1. Outcome Measures**

Peer Reviewed Publications

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 25 | 15 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Advances in knowledge of factors influencing our understanding and ability to manage biotechnology and genomics processes are critical to advancing our abilities beyond those based on conventional tools. The rigorous vetting of information and its sharing through peer-reviewed publications are primary means of moving these goals reliably forward.

What has been done

Multiple investigations have been conducted using novel and reliable approaches, and covering a wide variety of relevant topics.

Results

Fifteen peer reviewed publications were published in highly respected journals that are consulted and trusted by scientists worldwide. This creates changes in knowledge that leads to further advances in related areas.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 303 | Genetic Improvement of Animals |
| 212 | Pathogens and Nematodes Affecting Plants |
| 511 | New and Improved Non-Food Products and Processes |
| 206 | Basic Plant Biology |
| 304 | Animal Genome |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 305 | Animal Physiological Processes |
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources. |

Outcome #2**1. Outcome Measures**

Public understanding of Microbial opportunists

*Not reporting on this Outcome for this Annual Report***Outcome #3****1. Outcome Measures**

Number of farmers considering biological control

*Not reporting on this Outcome for this Annual Report***Outcome #4**

1. Outcome Measures

Number of Readers of Peer Reviewed Publications

*Not reporting on this Outcome for this Annual Report***Outcome #5****1. Outcome Measures**

Number in audience of class or scientific meeting

*Not reporting on this Outcome for this Annual Report***Outcome #6****1. Outcome Measures**

Number of Graduate students trained in laboratories

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 25 | 32 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Education and mentoring of graduate students produces new scientists, practitioners and leaders in relevant fields.

What has been done

Graduate students were supported and trained in twelve laboratories, and funded through USDA and multiple other granting entities.

Results

Thirty two graduate students were directly trained through projects supported within this program area. These students exhibit increased knowledge and abilities that will lead to continued advances in scientific and practical advances.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 511 | New and Improved Non-Food Products and Processes |
| 206 | Basic Plant Biology |
| 305 | Animal Physiological Processes |
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources. |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants |
| 135 | Aquatic and Terrestrial Wildlife |
| 212 | Pathogens and Nematodes Affecting Plants |
| 304 | Animal Genome |
| 303 | Genetic Improvement of Animals |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |

Outcome #7**1. Outcome Measures**

Number of undergraduate students trained in laboratory; involved in investigations

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 40 | 45 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Directly involving undergraduate students in research activities creates a link between theoretical and practical aspects of their education, and may lead them to consider the pursuit of research careers.

What has been done

Supported principle investigators solicit and engage undergraduate students in research activities including laboratory and field investigations.

Results

Forty five undergraduate students were engaged in research activities this year. Many received monetary compensation to help support their educations, and some undertake honors thesis, prepared research posters and presentations, and other relevant activities.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 212 | Pathogens and Nematodes Affecting Plants |
| 135 | Aquatic and Terrestrial Wildlife |
| 305 | Animal Physiological Processes |
| 304 | Animal Genome |
| 511 | New and Improved Non-Food Products and Processes |
| 303 | Genetic Improvement of Animals |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants |
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources. |
| 206 | Basic Plant Biology |

Outcome #8**1. Outcome Measures**

Number of postdoctoral fellows trained

*Not reporting on this Outcome for this Annual Report***Outcome #9****1. Outcome Measures**

Number of users of released DNA sequences, germplasm; ESTs, proteins

*Not reporting on this Outcome for this Annual Report***Outcome #10****1. Outcome Measures**

Change in policy

*Not reporting on this Outcome for this Annual Report***Outcome #11**

1. Outcome Measures

Number of grant submissions

*Not reporting on this Outcome for this Annual Report***Outcome #12****1. Outcome Measures**

Number of meetings/workshops attended

*Not reporting on this Outcome for this Annual Report***Outcome #13****1. Outcome Measures**

Increased knowledge and tools for practical use

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Incremental additions to our available knowledge and genetic/genomic resources or tools are critical for continued advances.

What has been done

Regulation of polyamine metabolism in poplar cells was evaluated in response to stressors. 57 germplasm accessions of wild and cultivated *Fragaria* were screened for resistance versus susceptibility to the fungal disease *Verticillium*. A novel approach to strawberry production was evaluated to extend season of availability and increase profitability. Research was conducted to determine the biochemical basis for the differences between rod and cone photoreceptors in the vertebrate retina.

Results

New sequences were added to the national database of expressed genes in poplar, to advance understanding of plant stress responses. Methods developed were used by the USDA-ARS and others for analysis of polyamines. Over 30 new strawberry hybrids and 10 segregating populations were generated for use in genetic studies to enhance production of superior varieties that will benefit producers and consumers. Fundamental new information about differences between rod and cone PDE6 aid in developing new treatments for retinal diseases afflicting humans and domestic and livestock animals.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 206 | Basic Plant Biology |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants |

Outcome #14**1. Outcome Measures**

Increased exposure and training of youth and underrepresented groups.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Perceptions of young and urban citizens will be critical to future applications of agricultural biotechnology and to related policies.

What has been done

A summer workshop dealing with agricultural biotechnology was conducted for 32 inner-city high school students from underrepresented and minority groups.

Results

The summer workshop augmented the interest and aptitude in agricultural sciences for 32 students representing underrepresented groups from inner-city high schools. These students will contribute to a change in societal attitudes toward agricultural biotechnology and may lead to their active participation in decision making about this important topic.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 206 | Basic Plant Biology |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |

Outcome #15**1. Outcome Measures**

New molecular approaches for specialty crop breeding.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Consumer and public health demands for healthy foods emphasize the importance of developing genomic knowledge needed by specialty crop breeders who seek to shorten the varietal development cycle by implementing marker-assisted breeding (MAB) techniques.

What has been done

Research at the NHAES isolated, sequenced and mapped several new genes of potential economic importance in relation to traits such as fruit quality, flowering habit, sex determination, and disease resistance.

Results

Using our newly developed method for DNA sequence walking, coding and promoter sequences were acquired for several genes of interest. A robust system for in vitro regeneration of genetically transformed strawberry plants was established to aid investigations of gene function. The research directly addressed the adverse environmental and health related impacts of pesticide and soil fumigant application by seeking genetic solutions to the widespread problem of the fungal verticillium wilt disease. Fifty seven germplasm accessions of wild and cultivated strawberries were screened, useful sources of resistance were discovered, and resistant x susceptible crosses were performed towards developing resistant varieties. Findings suggest that a powerful confocal microscopy technique can be used to quickly detect disease resistance, thereby providing a tool to speed the development of resistant varieties of many horticultural crops.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 206 | Basic Plant Biology |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 136 | Conservation of Biological Diversity |

Outcome #16**1. Outcome Measures**

Develop superior varieties of locally-adapted specialty crops.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|-------------|----------------------------|---------------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Increased public awareness of the dietary importance of healthful fruits, vegetables, and herbs creates both demand and opportunity for the development of new horticultural crop varieties.

What has been done

With the aim of forging a direct connection between basic genomics research and the breeding of locally adapted strawberry varieties for organic production, a novel approach to fall strawberry production was evaluated using multiple cultivars. These and other results provide a foundation for the initiation of a program of marker-assisted strawberry breeding.

Results

The research will provide tangible intermediate term benefit (within five to-ten years) to the citizens of New Hampshire, New England, and beyond by encouraging the development of locally adapted specialty crop varieties that will enhance opportunities for profitable, local crop production and marketing. By generating and disseminating knowledge via publically available venues and databases, this project has national and international synergies: reciprocal benefits have resulted from collaborations with researchers in eight states and nine countries.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|---|
| 206 | Basic Plant Biology |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 136 | Conservation of Biological Diversity |

Outcome #17

1. Outcome Measures

Improved knowledge of macular function in humans and animals.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Understanding the differences of rod and cone cell functioning is critical if we are to intervene in visual disturbances, retinal degenerations, and complete blindness that results from dysfunction of the cone photoreceptor cells in the retina. Cone cell dysfunction afflicting livestock and domestic animals and humans has been documented to occur from inherited genetic defects as well as from environmental/pharmacological assaults on cone cell functioning. The cellular basis for these adverse impacts on vision are poorly understood.

What has been done

Our research is developing new methods for isolating cone photoreceptor cells that will lead to new knowledge about unique aspects of cone cells that make them more susceptible than rods to genetic or environmental damage. We are also using recombinant protein expression of the catalytic subunit of cone PDE6 as a source of protein to directly contrast cone PDE6 with rod PDE6 regulation. This work will also identify how PDE6 drug specificity differs from the closely related PDE5 enzyme (a major therapeutic target for male erectile dysfunction and pulmonary hypertension). Our results have begun to identify some of the amino acids in cone PDE6 that are critical for the drug specificity of PDE5 inhibitors, as well as other amino acids in the catalytic domain that allow PDE6 catalysis to occur more quickly than PDE5.

Results

Resulting from this work is a better fundamental understanding of how cone PDE6 differs from PDE5 that can be applied to developing a new generation PDE5 inhibitor that lack adverse side effects on vision. Our results on the different biochemical properties of rod and cone cell proteins adds fundamental new knowledge of the cell signaling pathways that underlie the physiological differences of rods and cones to light stimulation. This work will eventually lead to new strategies for slowing and halting progressive retinal degenerative diseases that are common in certain animal breeds as well as in humans.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 511 | New and Improved Non-Food Products and Processes |
| 135 | Aquatic and Terrestrial Wildlife |
| 305 | Animal Physiological Processes |

V(H). Planned Program (External Factors)**External factors which affected outcomes**

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

Brief Explanation

V(l). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Before-After (before and after program)
- During (during program)

Evaluation Results

Key Items of Evaluation

Program #5

V(A). Planned Program (Summary)

1. Name of the Planned Program

Economics & Commerce

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|--------------|---|-----------------|-----------------|----------------|----------------|
| 602 | Business Management, Finance, and Taxation | | | 10% | |
| 603 | Market Economics | | | 20% | |
| 608 | Community Resource Planning and Development | | | 20% | |
| 610 | Domestic Policy Analysis | | | 20% | |
| 611 | Foreign Policy and Programs | | | 20% | |
| 803 | Sociological and Technological Change Affecting Individuals, Families and Communities | | | 10% | |
| Total | | | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

| Year: 2008 | Extension | | Research | |
|---------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 0.0 | 0.0 |
| Actual | 0.0 | 0.0 | 1.1 | 0.0 |

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

| Extension | | Research | |
|---------------------|----------------|----------------|----------------|
| Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| 0 | 0 | 208382 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 176975 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 0 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

A study evaluated the degree of privatization that municipalities are pursuing in providing solid waste management services. Information, best practices, training and outreach were provided to agencies and organizations affiliated with free tax preparation for low and moderate income individuals and families. A child care survey was conducted to identify the decision making processes used and the use of child care subsidies. Surveys were developed in order to ascertain the degree of corporate interest in offering a portion of currently off-shore jobs to individuals in New England. A survey of 500 New Hampshire residents evaluated their opinions of renewable energy.

2. Brief description of the target audience

Private municipalities, mothers and low income families and those requiring child care, corporations indicating an interest in rural sourcing, target groups interested in part-time or full-time employment, policy makers, decision makers and researchers statewide who have an interest in low income and/or rural populations, citizens and utilities interested in renewable energy.

V(E). Planned Program (Outputs)

1. Standard output measures

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|------|---------------------------|-----------------------------|--------------------------|----------------------------|
| Year | Target | Target | Target | Target |
| Plan | 12000 | 10000 | 0 | 0 |
| 2008 | 8000 | 5000 | 0 | 0 |

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

| Year | Target |
|--------|--------|
| Plan: | 0 |
| 2008 : | 0 |

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| | Extension | Research | Total |
|------|-----------|----------|-------|
| Plan | 0 | 1 | |
| 2008 | 0 | 6 | 6 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer Review Publications

| Year | Target | Actual |
|------|--------|--------|
| 2008 | 1 | 6 |

Output #2

Output Measure

- Non peer reviewed publications including abstracts

| Year | Target | Actual |
|------|--------|--------|
| 2008 | 1 | 4 |

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O No. | OUTCOME NAME |
|-------|---|
| 1 | Peer Reviewed publications |
| 2 | Obtaining additional funding to conduct detailed cost benefit analysis to select NH communities |
| 3 | Target entities obtain greater information to advance interests |

Outcome #1**1. Outcome Measures**

Peer Reviewed publications

*Not reporting on this Outcome for this Annual Report***Outcome #2****1. Outcome Measures**

Obtaining additional funding to conduct detailed cost benefit analysis to select NH communities

*Not reporting on this Outcome for this Annual Report***Outcome #3****1. Outcome Measures**

Target entities obtain greater information to advance interests

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Many citizens, private and public entities lack critical information to guide their activities. University scientists are uniquely positioned to provide or to assist in resolving such conditions.

What has been done

Investigation and surveys of varied stakeholders were conducted to evaluate opinions, attitudes, and use of resources important to societal functioning.

Results

Overall, local officials are less satisfied with municipal services provided under contract to private providers, relative to public entities. Rural families were found to be under-utilizing state child care subsidies. Companies were enthused by the fact that retirees interested in part-time work demonstrated the skills needed to undertake many employment opportunities that are currently allocated to off-shore employees. Most respondents favored mandatory green energy quotas in the state of New Hampshire, and many were open to the idea of solar hot water heaters in their homes. The willingness to adopt depended heavily on the cost of the system and the payback period in which they would recover that cost.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 803 | Sociological and Technological Change Affecting Individuals, Families and Communities |
| 611 | Foreign Policy and Programs |
| 610 | Domestic Policy Analysis |
| 608 | Community Resource Planning and Development |
| 603 | Market Economics |
| 602 | Business Management, Finance, and Taxation |

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

Program #6

V(A). Planned Program (Summary)

1. Name of the Planned Program

Food, Nutrition & Health

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|--------------|---|-----------------|-----------------|----------------|----------------|
| 133 | Pollution Prevention and Mitigation | | | 10% | |
| 304 | Animal Genome | | | 5% | |
| 403 | Waste Disposal, Recycling, and Reuse | | | 5% | |
| 607 | Consumer Economics | | | 5% | |
| 702 | Requirements and Function of Nutrients and Other Food Components | | | 20% | |
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources. | | | 10% | |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins | | | 15% | |
| 722 | Zoonotic Diseases and Parasites Affecting Humans | | | 15% | |
| 723 | Hazards to Human Health and Safety | | | 10% | |
| 724 | Healthy Lifestyle | | | 5% | |
| Total | | | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

| Year: 2008 | Extension | | Research | |
|---------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 1.2 | 0.0 |
| Actual | 0.0 | 0.0 | 1.6 | 0.0 |

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

| Extension | | Research | |
|---------------------|----------------|----------------|----------------|
| Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| 0 | 0 | 327522 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 294809 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 0 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

Efforts to strengthen local food systems were undertaken through support of the NH Farm to School program, a pilot program to integrate local food products into K-12 schools, working through the NH Center for a Secure Future, and the offering of numerous workshops, trainings, classroom presentations, online and print resources, and other educational materials. Investigations into Salmonella foodborne illness examined key components of the early events of infections to determine if intervention strategies could be proposed for preventing the clinical manifestations of this disease. Single and combined effects of two conditions of diabetes on atherosclerosis were evaluated using laboratory and swine in vivo studies. A study was completed which addressed the molecular biology of leukemogenesis in soft shell clams and its implications for the New England fisheries. Clam cancer is the best characterized naturally occurring malignancy with known molecular basis remarkably similar to those observed in several unrelated human cancers. A novel approach is being used to determine the relationship between dietary fatty acids, obesity, and allergic airway disease, with important health and agricultural implications. Studies, clinical trials and interviews related to improving availability and intake of fruit, vegetable and whole grain foods in older adults was undertaken, with particular focus on the relation to retinal health and macular degeneration. The regulation of Jagged1 mRNA expression in adipogenic cells by insulin and other inhibitors was evaluated in relation to obesity intervention. Levels of PBDE environmental pollutants in breast milk of lactating women were examined to evaluate potential relationships with stage of lactation, maternal characteristics, living environment and dietary intake. One PI was incapacitated by a medical condition, and received a no-cost extension.

2. Brief description of the target audience

Target audiences for this research include scientists, clinicians, nutritionists, lactation consultants, lactating women, animal feed and nutrition consultants and industries, food and pharmaceutical industries, aquaculture and fishing industries, undergraduate and graduate students, cooperative extension educators, health care workers and policy makers.

V(E). Planned Program (Outputs)

1. Standard output measures

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|-------------|-----------------------------------|-------------------------------------|----------------------------------|------------------------------------|
| Year | Target | Target | Target | Target |
| Plan | 1700 | 3070 | 10 | 0 |
| 2008 | 1200 | 2500 | 200 | 50 |

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

| Year | Target |
|--------------|---------------|
| Plan: | 0 |
| 2008 : | 0 |

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| | Extension | Research | Total |
|-------------|------------------|-----------------|--------------|
| Plan | 0 | 7 | |
| 2008 | 0 | 4 | 0 |

V(F). State Defined Outputs

Output Target

Output #1**Output Measure**

- Peer reviewed publications

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 7 | 4 |

Output #2**Output Measure**

- Chapters in Books

Not reporting on this Output for this Annual Report

Output #3**Output Measure**

- Author of book or editor of book

Not reporting on this Output for this Annual Report

Output #4**Output Measure**

- Non peer reviewed publications including abstracts

Not reporting on this Output for this Annual Report

Output #5**Output Measure**

- Reviewed publications including theses and abstracts

| Year | Target | Actual |
|-------------|-------------------|---------------|
| 2008 | {No Data Entered} | 3 |

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

| O No. | OUTCOME NAME |
|--------------|---|
| 1 | Peer Reviewed Publications |
| 2 | Number of graduate students trained |
| 3 | Number of Undergraduate students trained and/or performing investigations |
| 4 | Number of presentations/posters at regional, national or international conferences or workshops |
| 5 | Number of Grant submissions |
| 6 | Number of public presentations |
| 7 | Model Development |
| 8 | Town meetings |
| 9 | Results to NH DES |
| 10 | Increase options for combating important diseases |
| 11 | Increase knowledge and activities geared to nutritional health of older adults |
| 12 | Increase knowledge about foodborne illness affecting agricultural products and consumers |
| 13 | Increased understanding of dietary nutrients in macular degeneration and cataracts. |
| 14 | Understanding links between environmental chemicals, breastfeeding and obesity. |

Outcome #1**1. Outcome Measures**

Peer Reviewed Publications

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 7 | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

{No Data Entered}

What has been done

{No Data Entered}

Results

{No Data Entered}

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 724 | Healthy Lifestyle |
| 304 | Animal Genome |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins |
| 702 | Requirements and Function of Nutrients and Other Food Components |
| 403 | Waste Disposal, Recycling, and Reuse |
| 133 | Pollution Prevention and Mitigation |
| 723 | Hazards to Human Health and Safety |
| 722 | Zoonotic Diseases and Parasites Affecting Humans |
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources. |
| 607 | Consumer Economics |

Outcome #2**1. Outcome Measures**

Number of graduate students trained

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 7 | 9 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Changes in behavior and adoption of new skills and technologies by university graduate students who then actively apply these new tools, is a major way in which continued national success and progress toward objectives can be assured.

What has been done

Funded researchers trained, mentored, and integrally involved multiple graduate students in learning and applying new skills, knowledge, tools and abilities of importance to programmatic and societal goals.

Results

Nine graduate students have been trained as an integral part of these AES research projects. These individuals now apply improved fundamental and applied knowledge, improved skills, and new biological materials or processes to more effectively advance relevant national goals.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 304 | Animal Genome |
| 723 | Hazards to Human Health and Safety |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins |
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources. |
| 403 | Waste Disposal, Recycling, and Reuse |
| 702 | Requirements and Function of Nutrients and Other Food Components |
| 607 | Consumer Economics |
| 133 | Pollution Prevention and Mitigation |
| 724 | Healthy Lifestyle |
| 722 | Zoonotic Diseases and Parasites Affecting Humans |

Outcome #3

1. Outcome Measures

Number of Undergraduate students trained and/or performing investigations

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 5 | 12 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Intriguing and training undergraduate students in areas of importance to program and societal goals is critical to continued advances and success.

What has been done

Undergraduate students were integrally involved in multiple aspects of funded research projects, including laboratory and field investigations, learning and application of new information and techniques, and other contributions. Many earned money to assist with furthering their educations.

Results

Twelve undergraduate students meaningfully participated in funded projects, increasing their interests, knowledge and abilities in relevant areas. Many completed honors theses, and presented results of original research activities at the Undergraduate Research Conference and other venues.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 607 | Consumer Economics |
| 722 | Zoonotic Diseases and Parasites Affecting Humans |

| | |
|-----|---|
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources. |
| 702 | Requirements and Function of Nutrients and Other Food Components |
| 133 | Pollution Prevention and Mitigation |
| 723 | Hazards to Human Health and Safety |
| 403 | Waste Disposal, Recycling, and Reuse |
| 304 | Animal Genome |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins |

Outcome #4

1. Outcome Measures

Number of presentations/posters at regional, national or international conferences or workshops

Not reporting on this Outcome for this Annual Report

Outcome #5

1. Outcome Measures

Number of Grant submissions

Not reporting on this Outcome for this Annual Report

Outcome #6

1. Outcome Measures

Number of public presentations

Not reporting on this Outcome for this Annual Report

Outcome #7

1. Outcome Measures

Model Development

Not reporting on this Outcome for this Annual Report

Outcome #8

1. Outcome Measures

Town meetings

Not reporting on this Outcome for this Annual Report

Outcome #9

1. Outcome Measures

Results to NH DES

Not reporting on this Outcome for this Annual Report

Outcome #10

1. Outcome Measures

Increase options for combating important diseases

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Clam cancer is the best characterized naturally occurring malignancy with known molecular basis remarkably similar to those observed in several unrelated human cancers. Ability to work with non-human subjects to advance biomedical knowledge and techniques is critical.

What has been done

We developed methods for mass culture and long-term storage of tumor cells from the cancer in clams, the first successful efforts at maintaining malignant cells from any marine invertebrate in vitro.

Results

This new mass culture method provides biomedical and environmental researchers with ready access to an important naturally occurring cancer model.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 722 | Zoonotic Diseases and Parasites Affecting Humans |
| 723 | Hazards to Human Health and Safety |

Outcome #11**1. Outcome Measures**

Increase knowledge and activities geared to nutritional health of older adults

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Knowledge, availability and intake of healthy plant foods in older adults is critical to their health and quality of life, to agricultural enterprises, and to our health care system.

What has been done

Research, clinical trials, and surveys were conducted to investigate the knowledge, availability and impacts of fruits, vegetables and whole grains to nutrition and health impacts of older adults in New England.

Results

A whole grain foods curriculum was developed for use by extension educators to target older adults. This segment of our population is often at risk with respect to nutritious intake, which directly impacts health care options and costs.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 607 | Consumer Economics |
| 702 | Requirements and Function of Nutrients and Other Food Components |
| 724 | Healthy Lifestyle |

Outcome #12**1. Outcome Measures**

Increase knowledge about foodborne illness affecting agricultural products and consumers

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|-------------|----------------------------|---------------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Salmonella is a major foodborne illness that seriously affects multiple foods and consumers.

What has been done

We examined key components of the early events of infections to determine if intervention strategies could be proposed for preventing the clinical manifestations of this disease.

Results

A major outer membrane protein contributes to the initial adherence of Salmonella to both human intestinal cells and macrophages. This provides a focus point for intervention strategies that can block this adherence, thus aborting a potential infection. A second intervention target identified was the microbial-mediated alteration of the rate of apoptosis in neutrophils during transport through the intestinal epithelial monolayer. This new knowledge provides opportunities to substantially reduce the impact of Salmonella in the public.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|---|
| 607 | Consumer Economics |
| 712 | Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins |
| 724 | Healthy Lifestyle |
| 723 | Hazards to Human Health and Safety |

Outcome #13**1. Outcome Measures**

Increased understanding of dietary nutrients in macular degeneration and cataracts.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Lutein (L) and zeaxanthin (Z) are accessory pigments of photosynthesis and may serve an important role in human health. These pigments accumulate in the human retina where they are collectively called macular pigment (MP). MP is hypothesized to protect the central retina from the accumulated effects of light and oxygen. Both are necessary for normal vision, and there is a direct relationship between diets high in L/Z containing foods and MP density and an inverse relationship between MP density and risk for Age-related Macular Degeneration (AMD) and Cataract (ARC).

What has been done

Our research is focused on understanding the factors that influence uptake and deposition of dietary L/Z, and on increasing their concentration through collaboration with a UNH vegetable breeder.

Results

We showed that increasing the number of servings or the concentration per serving of L/Z vegetables will increase MP in most though not all individuals. Understanding these differences in response may help determine risk factors for chronic disease with aging, which is a national concern due to high public cost.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 724 | Healthy Lifestyle |
| 702 | Requirements and Function of Nutrients and Other Food Components |

Outcome #14**1. Outcome Measures**

Understanding links between environmental chemicals, breastfeeding and obesity.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The level of synthetic flame retardants in breast milk of New Hampshire women is unknown. One class of flame retardants is polybrominated diphenylethers (PBDEs), which are known endocrine disruptors. The factors that can influence these breast milk levels, or the propensity for flame retardants to promote obesity, is also unknown.

What has been done

Forty women from the Seacoast area of New Hampshire, ages 22-40, provided breast milk samples at months 1, 2 and 3 of lactation for analysis of 8 flame retardant congeners, along with information about their diet, living environment and demographics. To test for flame retardant's ability to promote obesity, rats were exposed to flame retardants for one month and endocrine disruption was measured in blood and in fat cells.

Results

Results indicate that PBDE levels in breast milk from the state of New Hampshire are within the range that has been reported in the U.S., and that levels are stable during the first three-months of lactation. Our findings revealed a higher predominance pattern with BDE-153 compared to other studies, and indicated that PBDE levels are influenced by age, diet, and the home environment. An association between fruit consumption and PBDE levels during the last trimester was surprising, and suggests that plant-based foods reduce the PBDE body burden by an unknown mechanism. The animal data suggests that PBDEs could provoke the development of metabolic obesity in rats; the effect in humans remains unknown.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 711 | Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources. |
| 702 | Requirements and Function of Nutrients and Other Food Components |
| 724 | Healthy Lifestyle |
| 723 | Hazards to Human Health and Safety |

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

Program #7

V(A). Planned Program (Summary)

1. Name of the Planned Program

Natural Resources & Environment

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|--------------|--|-----------------|-----------------|----------------|----------------|
| 112 | Watershed Protection and Management | | | 7% | |
| 122 | Management and Control of Forest and Range Fires | | | 7% | |
| 123 | Management and Sustainability of Forest Resources | | | 10% | |
| 132 | Weather and Climate | | | 10% | |
| 135 | Aquatic and Terrestrial Wildlife | | | 20% | |
| 136 | Conservation of Biological Diversity | | | 18% | |
| 215 | Biological Control of Pests Affecting Plants | | | 5% | |
| 314 | Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals | | | 5% | |
| 315 | Animal Welfare/Well-Being and Protection | | | 5% | |
| 403 | Waste Disposal, Recycling, and Reuse | | | 5% | |
| 605 | Natural Resource and Environmental Economics | | | 8% | |
| Total | | | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

| Year: 2008 | Extension | | Research | |
|---------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 6.0 | 0.0 |
| Actual | 0.0 | 0.0 | 3.3 | 0.0 |

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

| Extension | | Research | |
|---------------------|----------------|----------------|----------------|
| Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| 0 | 0 | 517785 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 517785 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 164437 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

Extent and intensity of invasion by glossy buckthorn in New England forests was investigated in cut and uncut areas in relation to forest type and geometry, logging intensity, and canopy opening size. Forest surveys were conducted to assess the effects of white tailed deer foraging in the spread of invasive shrubs. The impacts of land use change and fragmentation on water quality was investigated using 15 sub-basins of the wild and scenic Lamprey River in New Hampshire. Water samples were analyzed for multiple chemical and biological indicators, the distribution of impervious surfaces was characterized, and land use and population densities were spatially classified. The information will be used to develop guidelines for developing sustainable forestry and rural practices that contribute to maintaining water quality. The effects of forest fragmentation on dispersal of amphibians that breed in vernal pools were evaluated using a landscape and genetics approach. Key indicator amphibians were captured and tagged, DNA analyses conducted, and geostatistical analyses of multiple landscape variables undertaken to explain the influences of roads and suburban development on amphibian population connectivity. Some key impacts of potential global climate changes were studied through focus on the composition and activities of forest soil microbial communities in response to chronic warming and nitrogen deposition. Efficient methods for timber and forest structural legacy inventory were developed, and historical trends in stocking and structure in managed lands were characterized to develop guidance for stand management across New Hampshire. AES field research in cooperation with NH Fish and Game and the Department of Environmental Services directly led to an extension document that was created to provide guidance on wetland assessment and conservation, which was sent to all town conservation commissions in New Hampshire as well as to hundreds of interested stakeholders, and is available for download from a prominent UNH website. The aquatic insect fauna of 24 streams and rivers in White Mountain National Forest were sampled to determine species-level biodiversity throughout the season. The influences of trematode parasites on the ecology of nearshore marine communities was investigated, and local site variability in the abundance of gulls, the primary host for the trematodes, was identified as the main driver of parasite prevalence at large spatial scales. Multiple marine invertebrates were sampled and catalogued using molecular barcodes to help evaluate inter- and intra-specific variations that will help in conclusive identification and distinction of these species, with submissions made to GenBank so they are now available to the public.

2. Brief description of the target audience

Target audiences include scientists, forest ecologists and managers, wildlife and conservation biologists, invasion biologists, fisheries and aquaculture managers, natural resource professionals, conservation groups, undergraduate and graduate students, cooperative extension educators, rural citizens, landowners, policy makers, state and federal agencies, legislators, planners, managers, and other stakeholders.

V(E). Planned Program (Outputs)

1. Standard output measures

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|------|---------------------------|-----------------------------|--------------------------|----------------------------|
| Year | Target | Target | Target | Target |
| Plan | 6294 | 3528 | 150 | 480 |
| 2008 | 5500 | 3000 | 175 | 525 |

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

| Year | Target |
|--------|--------|
| Plan: | 0 |
| 2008 : | 0 |

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| | Extension | Research | Total |
|-------------|------------------|-----------------|--------------|
| Plan | 0 | 32 | |
| 2008 | 0 | 22 | 21 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer-Reviewed Publications

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 32 | 22 |

Output #2

Output Measure

- Chapters in Books

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 8 | 2 |

Output #3

Output Measure

- Author of book or editor

Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Non-peer reviewed publications including published abstracts

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 34 | 6 |

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

| O No. | OUTCOME NAME |
|--------------|---|
| 1 | Peer Reviewed Publications |
| 2 | Number of Graduate Students trained |
| 3 | Number of Undergraduate students trained and/or performing investigations |
| 4 | Number of presentations/posters at regional, national or international conferences or workshops |
| 5 | Number of Grant submissions |
| 6 | Number of agencies better informed about amphibian habitat needs |
| 7 | Use of more precise biological data in making water quality statements |
| 8 | Use of biological data by aquatic entomologists |
| 9 | Number in audience of meeting presentations |
| 10 | Number of resources managers addressed |
| 11 | Number of workshops held |
| 12 | Number of websites developed |
| 13 | Public service announcement |
| 14 | Number of trade publications |
| 15 | Lake Management plans that consider biotoxin problems |
| 16 | Development of NH state drinking water program with biotoxin control |
| 17 | Foresters learning about methods to reduce spread of invasive species |
| 18 | Identification of invasive species |
| 19 | CZM manager, environmental resource groups/individuals |
| 20 | Dissemination of results to land ure planners |
| 21 | websurveys |
| 22 | Questionnaire |
| 23 | Enhance knowledge of lobsters, improve management; educate community |
| 24 | Increase knowledge of global change impacts on soil processes |
| 25 | New forest inventory and analysis methods |
| 26 | Incorporate aquatic insect indicators into water projects |
| 27 | More effective forest growth and structure inventory estimates. |
| 28 | Understanding severity of cyanobacteria floomw on domestic animals and wildlife. |
| 29 | Improve abilities to monitor lake sediments. |

Outcome #1**1. Outcome Measures**

Peer Reviewed Publications

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 20 | 21 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Advances in knowledge of factors influencing our understanding and ability to manage biotechnology and genomics processes are critical to advancing our abilities beyond those based on conventional tools. The rigorous vetting of information and its sharing through peer-reviewed publications are primary means of moving these goals reliably forward.

What has been done

Multiple investigations were undertaken using objective, novel and reliable approaches, and covering a wide variety of relevant topics.

Results

Twenty one peer reviewed publications were published in highly respected journals that are consulted and trusted by scientists worldwide. This creates changes in knowledge that leads to further advances in related areas.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 605 | Natural Resource and Environmental Economics |
| 136 | Conservation of Biological Diversity |
| 403 | Waste Disposal, Recycling, and Reuse |
| 315 | Animal Welfare/Well-Being and Protection |
| 132 | Weather and Climate |
| 123 | Management and Sustainability of Forest Resources |
| 135 | Aquatic and Terrestrial Wildlife |
| 122 | Management and Control of Forest and Range Fires |
| 112 | Watershed Protection and Management |

Outcome #2**1. Outcome Measures**

Number of Graduate Students trained

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 28 | 29 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Changes in behavior and adoption of new skills and technologies by university graduate students who then actively apply and disseminate these new tools, is a major way to assure continued national success and progress toward shared societal objectives.

What has been done

Funded scientists trained, mentored, and integrally involved multiple graduate students in learning and applying new skills, knowledge, tools and abilities of importance to programmatic and societal goals.

Results

Twenty nine graduate students were trained as an integral part of these AES research projects. These students and early career individuals now apply improved fundamental and applied knowledge, improved skills, and new technologies or processes to more effectively advance relevant national goals.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 136 | Conservation of Biological Diversity |
| 112 | Watershed Protection and Management |
| 314 | Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals |
| 605 | Natural Resource and Environmental Economics |
| 315 | Animal Welfare/Well-Being and Protection |
| 135 | Aquatic and Terrestrial Wildlife |
| 403 | Waste Disposal, Recycling, and Reuse |
| 122 | Management and Control of Forest and Range Fires |
| 123 | Management and Sustainability of Forest Resources |
| 132 | Weather and Climate |

Outcome #3**1. Outcome Measures**

Number of Undergraduate students trained and/or performing investigations

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 27 | 11 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Getting undergraduate students interested in working in areas of importance to program and societal goals, and advancing their training and competence in these areas, is critical to continued advances and success.

What has been done

Undergraduate students were incorporated into multiple aspects of funded research projects, including laboratory and field investigations, learning and application of new information and techniques, and other contributions. Many were paid for their activities, which will help meet costs of continuing their educations.

Results

Eleven undergraduate students meaningfully participated in funded projects, increasing their interests, knowledge and abilities in relevant areas. Several completed undergraduate honors theses, presented original research results at the Undergraduate Research Conference, and participated in increasing public understanding of related topics through additional venues.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 135 | Aquatic and Terrestrial Wildlife |
| 136 | Conservation of Biological Diversity |
| 315 | Animal Welfare/Well-Being and Protection |
| 123 | Management and Sustainability of Forest Resources |
| 122 | Management and Control of Forest and Range Fires |
| 403 | Waste Disposal, Recycling, and Reuse |
| 605 | Natural Resource and Environmental Economics |
| 314 | Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals |
| 112 | Watershed Protection and Management |
| 132 | Weather and Climate |

Outcome #4

1. Outcome Measures

Number of presentations/posters at regional, national or international conferences or workshops

Not reporting on this Outcome for this Annual Report

Outcome #5

1. Outcome Measures

Number of Grant submissions

Not reporting on this Outcome for this Annual Report

Outcome #6

1. Outcome Measures

Number of agencies better informed about amphibian habitat needs

Not reporting on this Outcome for this Annual Report

Outcome #7

1. Outcome Measures

Use of more precise biological data in making water quality statements

Not reporting on this Outcome for this Annual Report

Outcome #8

1. Outcome Measures

Use of biological data by aquatic entomologists

Not reporting on this Outcome for this Annual Report

Outcome #9

1. Outcome Measures

Number in audience of meeting presentations

Not reporting on this Outcome for this Annual Report

Outcome #10

1. Outcome Measures

Number of resources managers addressed

Not reporting on this Outcome for this Annual Report

Outcome #11

1. Outcome Measures

Number of workshops held

Not reporting on this Outcome for this Annual Report

Outcome #12

1. Outcome Measures

Number of websites developed

Not reporting on this Outcome for this Annual Report

Outcome #13

1. Outcome Measures

Public service announcement

Not reporting on this Outcome for this Annual Report

Outcome #14

1. Outcome Measures

Number of trade publications

Not reporting on this Outcome for this Annual Report

Outcome #15

1. Outcome Measures

Lake Management plans that consider biotoxin problems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 0 | 63 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Biotoxins represent a significant health risk to drinking water in New Hampshire, New England, and other areas of the world.

What has been done

Research results indicate that cyanobacteria blooms and their associated toxins represent a potential threat to the public health as well as to the health of wildlife, pets and other domestic animals.

Results

Interest resulted in a motion by the NH State Lakes Management Advisory Committee (LMAC) to develop a workshop on monitoring cyanotoxins. Discussions among the 63 participants included how the medical profession and public should respond to incidents of cyanobacteria blooms and toxicities. Also at the workshop were information booths from NH DES and UNH Cooperative Extension along with a video on cyanobacteria that was specially created for this event.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|-------------------------------------|
| 135 | Aquatic and Terrestrial Wildlife |
| 112 | Watershed Protection and Management |

Outcome #16**1. Outcome Measures**

Development of NH state drinking water program with biotoxin control

Not reporting on this Outcome for this Annual Report

Outcome #17**1. Outcome Measures**

Foresters learning about methods to reduce spread of invasive species

Not reporting on this Outcome for this Annual Report

Outcome #18**1. Outcome Measures**

Identification of invasive species

Not reporting on this Outcome for this Annual Report

Outcome #19**1. Outcome Measures**

CZM manager, environmental resource groups/individuals

Not reporting on this Outcome for this Annual Report

Outcome #20**1. Outcome Measures**

Dissemination of results to land use planners

Not reporting on this Outcome for this Annual Report

Outcome #21**1. Outcome Measures**

websurveys

Not reporting on this Outcome for this Annual Report

Outcome #22**1. Outcome Measures**

Questionnaire

Not reporting on this Outcome for this Annual Report

Outcome #23

1. Outcome Measures

Enhance knowledge of lobsters, improve management; educate community

Not reporting on this Outcome for this Annual Report

Outcome #24**1. Outcome Measures**

Increase knowledge of global change impacts on soil processes

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Forest productivity depends strongly on nutrient cycling processes mediated by soil microorganisms. Microbial activity in turn is controlled to a large degree by temperature, moisture, and nutrient availability. Climate warming and nitrogen (N) deposition, two environmental changes important to the New England region, may alter microbial community structure and function and hence, forest productivity.

What has been done

Some key impacts of potential global climate changes were studied through focus on the composition and activities of forest soil microbial communities in response to chronic warming and nitrogen deposition. We are investigating how these two stressors interact to influence soil nutrient cycling dynamics. This is important because these factors do not impact ecosystems independent of one another, but interact to influence ecosystems in complex and often unpredictable ways.

Results

A primary outcome of this project has been the improved understanding of how long-term soil warming and N additions influence soil C storage and microbial dynamics. We have learned, for example, that both warming and nitrogen fertilization reduce the level of microbial biomass, with the fungal component of the microbial community being particularly affected. Chronic warming stimulates soil respiration and nitrogen cycling, while nitrogen fertilization inhibits litter decomposition and enhances soil carbon storage. This knowledge is highly important in planning for agricultural and forest productivity management under changing climate conditions.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 123 | Management and Sustainability of Forest Resources |
| 132 | Weather and Climate |
| 136 | Conservation of Biological Diversity |
| 605 | Natural Resource and Environmental Economics |
| 112 | Watershed Protection and Management |

Outcome #25**1. Outcome Measures**

New forest inventory and analysis methods

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Accurate methods to inventory timber lands are critical for sustained harvest and conservation purposes.

What has been done

Efficient methods for timber and structural legacy inventory in New England forests were developed, tested, and refined. New basic and applied knowledge includes resolution of the challenges of boundary overlap in simple and cluster plot designs, improved methods for structural legacy inventory in northeastern forests that were successfully transferred to western U.S. forests, and improved techniques for evaluating stocking in even- and uneven-aged forests in New Hampshire.

Results

Resulting new practices were adopted by several opinion-leading practitioners and groups. Our methods of boundary overlap correction have been taught to hundreds of field foresters, and have been adopted by several large landowners and land management agencies, including two consulting firms responsible for the management of significant forested acreage in Maine, New Hampshire, and Vermont, and also by the Province of British Columbia. These methods provide reduced bias and greater accuracy in forest inventories, while reducing cost relative to common practice. Our methods for structural legacy inventory, especially perpendicular distance sampling, have been taught to hundreds of field foresters and ecologists in a series of workshops, and have been adopted for use on tens of thousands of acres of conservation land in New Hampshire.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 123 | Management and Sustainability of Forest Resources |
| 136 | Conservation of Biological Diversity |
| 112 | Watershed Protection and Management |
| 122 | Management and Control of Forest and Range Fires |
| 605 | Natural Resource and Environmental Economics |

Outcome #26**1. Outcome Measures**

Incorporate aquatic insect indicators into water projects

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Aquatic invertebrate insects are key indicators of water quality and related indices of importance to conservation of resources. The information is critical to guide projects which might impact related resources.

What has been done

The aquatic insect fauna of 24 streams and rivers in White Mountain National Forest were sampled to determine species-level biodiversity throughout the season. The information was used to develop keys for use in myriad applications.

Results

The development of comprehensive, illustrated, species-level keys for the aquatic insects of New England has increased interest in working at more precise levels among contractors and state agencies. This documentation adds maximum precision to statements and activities concerning water quality.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 605 | Natural Resource and Environmental Economics |
| 136 | Conservation of Biological Diversity |
| 132 | Weather and Climate |
| 135 | Aquatic and Terrestrial Wildlife |
| 112 | Watershed Protection and Management |

Outcome #27**1. Outcome Measures**

More effective forest growth and structure inventory estimates.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Effective and economical forest management relies on accurate estimates of trends in forest growth and structure.

What has been done

Recent historical data and multiple sources of older information were used to evaluate trends in stocking and structure in managed forest lands of northern New Hampshire, and to develop guidance for stand management across the range of forest types found in the state. Using previous long-term plot data, we constructed a geographically-weighted growth model for the tree species of the northeast, and used that model to examine large scale patterns of forest productivity.

Results

This AES research was leveraged to obtain \$144,000 in additional funds to date, and serves as a baseline for mapping growth potential and for understanding climate change response in the northeastern United States. We developed methods to model crown rise in eastern white pine stands, and have been using those methods to inform a hybrid empirical-process model of forest growth in these stands. The new inventory methods have been adopted by multiple foresters and landowners, including those trained in a series of workshops from 2005 through 2007.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 123 | Management and Sustainability of Forest Resources |

Outcome #28

1. Outcome Measures

Understanding severity of cyanobacteria bloom on domestic animals and wildlife.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Cyanobacterial blooms release toxins that affect humans, as well as domestic and wild animals.

What has been done

NHAES scientists have been meeting with the New Hampshire Veterinary Diagnostic Laboratory to develop a program for conducting necropsies and tissue examinations of domestic animals and wildlife that have been exposed to cyanobacteria blooms.

Results

The cyanobacteria testing program will provide essential data to better understand the severity and extent of the problem of cyanotoxins in New Hampshire and northern New England. This diagnostic program would also provide valuable training for students interested in the field of environmental health.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 135 | Aquatic and Terrestrial Wildlife |
| 314 | Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals |
| 315 | Animal Welfare/Well-Being and Protection |
| 112 | Watershed Protection and Management |

Outcome #29**1. Outcome Measures**

Improve abilities to monitor lake sediments.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Knowledge and understanding of water chemical and microbial status and history through sampling of bottom sediments is hindered by lack of suitable measurement approaches.

What has been done

A new device for sampling the surface of lake sediments was developed cooperatively with Aquatic Research Instruments, Inc. this provides the utility of a benthic sampler that collects the uppermost sediments which contain the highest concentrations of lake cyanobacteria toxins. The device is simple to use and is especially designed for use by citizen monitors.

Results

At the end of this study we will make this device available for application in for water quality monitoring programs.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 135 | Aquatic and Terrestrial Wildlife |
| 112 | Watershed Protection and Management |
| 314 | Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals |

V(H). Planned Program (External Factors)**External factors which affected outcomes**

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

Brief Explanation**V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

Program #8**V(A). Planned Program (Summary)****1. Name of the Planned Program**

Pest Management

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|--|-----------------|-----------------|----------------|----------------|
| 215 | Biological Control of Pests Affecting Plants | | | 100% | |
| | Total | | | 100% | |

V(C). Planned Program (Inputs)**1. Actual amount of professional FTE/SYs expended this Program**

| Year: 2008 | Extension | | Research | |
|---------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 0.3 | 0.0 |
| Actual | 0.0 | 0.0 | 0.4 | 0.0 |

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

| Extension | | Research | |
|---------------------|----------------|----------------|----------------|
| Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| 0 | 0 | 46877 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 36537 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 0 | 0 |

V(D). Planned Program (Activity)**1. Brief description of the Activity**

Although the endocrine control of reproduction has been investigated in a few model species, little is known about the hormonal control of reproductive behavior. Burying beetles have become a model system to investigate the interactions of hormones and behavior, especially for beetles with complex reproductive bouts and parental care. The effect of juvenile hormone on larval begging behavior, and the perception of population density on the trade-off between the number and size of larvae in a clutch are being investigated.

2. Brief description of the target audience

The target audience includes university students, and the scientific community interested in behavioral ecology or behavioral endocrinology.

V(E). Planned Program (Outputs)

1. Standard output measures

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|-------------|-----------------------------------|-------------------------------------|----------------------------------|------------------------------------|
| Year | Target | Target | Target | Target |
| Plan | 50 | 50 | 0 | 0 |
| 2008 | 0 | 0 | 0 | 0 |

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

| Year | Target |
|--------------|---------------|
| Plan: | 0 |
| 2008 : | 0 |

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| | Extension | Research | Total |
|-------------|------------------|-----------------|--------------|
| Plan | 0 | 0 | |
| 2008 | 0 | 0 | 0 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer Reviewed Publications

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 1 | 1 |

Output #2

Output Measure

- Chapters in Books

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 0 | 0 |

Output #3

Output Measure

- Non peer reviewed publications including abstracts

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 1 | 0 |

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

| O No. | OUTCOME NAME |
|--------------|--|
| 1 | Peer Reviewed Publications |
| 2 | Increase in knowledge |
| 3 | Increased understanding of beetle reproductive behavior. |

Outcome #1**1. Outcome Measures**

Peer Reviewed Publications

*Not reporting on this Outcome for this Annual Report***Outcome #2****1. Outcome Measures**

Increase in knowledge

*Not reporting on this Outcome for this Annual Report***Outcome #3****1. Outcome Measures**

Increased understanding of beetle reproductive behavior.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Many beetles are serious pests of crops and forests. Little is known about the hormonal control of reproductive behavior in beetles. Increased knowledge is critical to development of effective control measures.

What has been done

Burying beetles have become a model system to investigate interactions between hormones and behavior, especially for beetles with complex reproductive bouts and parental care. The effect of juvenile hormone on larval begging behavior, and the perception of population density on the trade off between the number and size of larvae in a clutch are being investigated for burying beetle.

Results

Juvenile hormone and circulating biogenic amines were evaluated for their roles in promoting reproductive physiology and behavior. Results are disseminated to stakeholders through conferences and other meetings, reviewed and peer reviewed papers, and personal interactions with scientists and managers.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 215 | Biological Control of Pests Affecting Plants |

V(H). Planned Program (External Factors)**External factors which affected outcomes**

- Natural Disasters (drought, weather extremes, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

Program #9

V(A). Planned Program (Summary)

1. Name of the Planned Program

Plants & Plant Products

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

| KA Code | Knowledge Area | %1862 Extension | %1890 Extension | %1862 Research | %1890 Research |
|---------|---|-----------------|-----------------|----------------|----------------|
| 136 | Conservation of Biological Diversity | | | 5% | |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms | | | 18% | |
| 202 | Plant Genetic Resources | | | 15% | |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants | | | 10% | |
| 204 | Plant Product Quality and Utility (Preharvest) | | | 5% | |
| 205 | Plant Management Systems | | | 15% | |
| 206 | Basic Plant Biology | | | 12% | |
| 211 | Insects, Mites, and Other Arthropods Affecting Plants | | | 10% | |
| 212 | Pathogens and Nematodes Affecting Plants | | | 5% | |
| 216 | Integrated Pest Management Systems | | | 5% | |
| | Total | | | 100% | |

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

| Year: 2008 | Extension | | Research | |
|---------------|-----------|------|----------|------|
| | 1862 | 1890 | 1862 | 1890 |
| Plan | 0.0 | 0.0 | 1.2 | 0.0 |
| Actual | 0.0 | 0.0 | 1.5 | 0.0 |

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

| Extension | | Research | |
|---------------------|----------------|----------------|----------------|
| Smith-Lever 3b & 3c | 1890 Extension | Hatch | Evans-Allen |
| 0 | 0 | 243618 | 0 |
| 1862 Matching | 1890 Matching | 1862 Matching | 1890 Matching |
| 0 | 0 | 180619 | 0 |
| 1862 All Other | 1890 All Other | 1862 All Other | 1890 All Other |
| 0 | 0 | 0 | 0 |

V(D). Planned Program (Activity)

1. Brief description of the Activity

We conducted studies concerning cultural factors that influence production and landscape establishment of trees and shrubs, by comparing growth in modified container production systems to maintain optimal temperatures in the root zone environment for as much of the year as possible. Breeding lines of melon, ornamental pumpkin, summer squash, gourds, winter squash and tomato are being developed with improvements in disease resistance, eating and shipping quality, nutrition and earlier maturity. These foci dovetail nicely with increased emphasis on small farm production for local markets. Several different vegetal and small fruit varieties and cultural practices were pursued for potential improved production in New Hampshire. Sixteen varieties of sweet potato and the effects of row covers and IRT mulches on their yield were investigated. Yields of seven different varieties of winter sprouting broccoli under different production methods were measured to test the feasibility of this crop for high tunnels in New England. Historical and recent floristic studies, rapid assessment surveys and molecular investigations were used to evaluate the occurrence of 20 seaweeds introduced to the northwest Atlantic ocean. Taxonomy and phylogeography of populations of the red seaweed genus *Porphyra* were quantified and the ecological impacts of introduced Asian species assessed at several locations in New England. Potential generalized stress responses at the cellular and tissue level for sunflower leaves exposed to mechanical injury and osmotic stress were investigated. The inhibition of photosynthesis by iron deficiency and oxidative stress was investigated in the laboratory.

2. Brief description of the target audience

Target audiences include commercial and home gardeners, plant breeders, seed companies, consumers, marine producers and regulators, conservation groups, the international scientific community, undergraduate and graduate students, cooperative extension educators, conventional and organic farmers and future farmers in the region, and indirectly, consumers of food in the region.

V(E). Planned Program (Outputs)

1. Standard output measures

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

| | Direct Contacts Adults | Indirect Contacts Adults | Direct Contacts Youth | Indirect Contacts Youth |
|------|---------------------------|-----------------------------|--------------------------|----------------------------|
| Year | Target | Target | Target | Target |
| Plan | 1460 | 10490 | 10 | 20 |
| 2008 | 1700 | 1100 | 105 | 165 |

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

| Year | Target |
|--------|--------|
| Plan: | 2 |
| 2008 : | 0 |

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

| | Extension | Research | Total |
|------|-----------|----------|-------|
| Plan | 0 | 7 | |
| 2008 | 0 | 7 | 0 |

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer-reviewed publications

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 7 | 7 |

Output #2

Output Measure

- Chapters in Books

Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Non-peer reviewed publications including abstracts

| Year | Target | Actual |
|-------------|---------------|---------------|
| 2008 | 17 | 5 |

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

| O No. | OUTCOME NAME |
|-------|---|
| 1 | Peer Reviewed Publications |
| 2 | Number of Graduate Students Trained |
| 3 | Number of Undergraduate students trained and/or performing investigations |
| 4 | Number of presentations/posters at regional, national or international conferences or workshops |
| 5 | Change in Knowledge in field |
| 6 | Growers improve water & fertilizer use |
| 7 | Growers improve fungus gnat management |
| 8 | Growers improve borytis management |
| 9 | Growers adopt new genetics or new technology |
| 10 | No. of farmers learning about new vegetable varieties |
| 11 | No. of farmers learning about new fruit varieties |
| 12 | No. of farmers learning about season extension |
| 13 | Producers adopting varieties and production methods |
| 14 | Increase knowledge of introduced and invasive marine plants |
| 15 | Produce new functional food products that directly improve human health and wellbeing. |
| 16 | Develop new and improved varieties of vegetable crops. |

Outcome #1**1. Outcome Measures**

Peer Reviewed Publications

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 7 | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Advances in knowledge and abilities to produce safe and healthy plants and plant products are critical to feeding our region and country. The rigorous vetting of information and its sharing through peer-reviewed publications are primary means of moving these goals reliably forward.

What has been done

We conducted multiple investigations covering a wide variety of relevant topics.

Results

Seven peer reviewed publications were published in highly respected journals that are consulted and trusted by scientists worldwide. This creates changes in knowledge that leads to further advances in related areas.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 206 | Basic Plant Biology |
| 205 | Plant Management Systems |
| 204 | Plant Product Quality and Utility (Preharvest) |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants |
| 136 | Conservation of Biological Diversity |
| 202 | Plant Genetic Resources |

Outcome #2**1. Outcome Measures**

Number of Graduate Students Trained

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 4 | 6 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Changes in behavior and adoption of new skills and technologies by university graduate students who then actively apply these new tools, is a major way in which continued national success and progress toward objectives can be assured.

What has been done

Funded researchers trained, mentored, and integrally involved multiple graduate students in learning and applying new skills, knowledge, tools and abilities of importance to programmatic and societal goals.

Results

Six graduate students have been trained as an integral part of these AES research projects. These individuals now apply improved fundamental and applied knowledge, improved skills, and carry forward new varieties or processes to more effectively advance relevant national goals.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants |
| 202 | Plant Genetic Resources |
| 136 | Conservation of Biological Diversity |
| 204 | Plant Product Quality and Utility (Preharvest) |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 205 | Plant Management Systems |
| 206 | Basic Plant Biology |

Outcome #3

1. Outcome Measures

Number of Undergraduate students trained and/or performing investigations

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 5 | 3 |

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Intriguing and training undergraduate students in areas of importance to program and societal goals is critical to continued advances and success.

What has been done

Undergraduate students were integrally involved in funded research projects, including laboratory and field investigations, learning and application of new information and techniques, and other contributions. Many earned money to assist with furthering their educations.

Results

Three undergraduate students meaningfully participated in funded projects, increasing their interests, knowledge and abilities in relevant areas.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|---|
| 136 | Conservation of Biological Diversity |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 205 | Plant Management Systems |
| 204 | Plant Product Quality and Utility (Preharvest) |
| 203 | Plant Biological Efficiency and Abiotic Stresses Affecting Plants |
| 202 | Plant Genetic Resources |

Outcome #4**1. Outcome Measures**

Number of presentations/posters at regional, national or international conferences or workshops

Not reporting on this Outcome for this Annual Report

Outcome #5**1. Outcome Measures**

Change in Knowledge in field

Not reporting on this Outcome for this Annual Report

Outcome #6**1. Outcome Measures**

Growers improve water & fertilizer use

Not reporting on this Outcome for this Annual Report

Outcome #7**1. Outcome Measures**

Growers improve fungus gnat management

Not reporting on this Outcome for this Annual Report

Outcome #8**1. Outcome Measures**

Growers improve borytis management

Not reporting on this Outcome for this Annual Report

Outcome #9**1. Outcome Measures**

Growers adopt new genetics or new technology

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | 1500 | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Consumers and producers are highly interested in superior vegetable products.

What has been done

Breeding lines of multiple vegetable crops are being developed with improvements in disease resistance, eating and shipping quality, nutrition and earlier maturity. These foci dovetail nicely with increased emphasis on small farm production for local markets.

Results

New cucurbit vegetal varieties became available to growers through collaborative arrangements and contracts with several seed companies. Over 45 varieties have been released and are being offered for sale by seed companies from this project during the past 15 years. Several other varieties and products are in various stages of development.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 202 | Plant Genetic Resources |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 204 | Plant Product Quality and Utility (Preharvest) |
| 205 | Plant Management Systems |

Outcome #10**1. Outcome Measures**

No. of farmers learning about new vegetable varieties
Not reporting on this Outcome for this Annual Report

Outcome #11**1. Outcome Measures**

No. of farmers learning about new fruit varieties
Not reporting on this Outcome for this Annual Report

Outcome #12**1. Outcome Measures**

No. of farmers learning about season extension
Not reporting on this Outcome for this Annual Report

Outcome #13**1. Outcome Measures**

Producers adopting varieties and production methods

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|-------------|----------------------------|---------------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

It is critical to both producers and consumers that more suitable, economically viable, or successful methods and varieties become available to produce landscape and food plant products.

What has been done

We compared plant growth in modified container production systems to maintain optimal temperatures in the root zone environment. Sixteen varieties of sweet potato and the effects of row covers and IRT mulches on their yield were investigated. Yields of seven different varieties of winter sprouting broccoli under different production methods were measured to test the feasibility of this crop for high tunnels in New England.

Results

Over ten growers in New Hampshire have adapted some of the container production practices from this research. As a direct result of our experiments and outreach, at least nine commercial vegetable growers in New Hampshire and Vermont grew trial commercial plots of sweet potatoes. At least two producers who had grown sweet potatoes previously reported that they changed their production and marketing practices based on this research. For the 2008 growing season, the estimated retail dollar value of the sweetpotatoes grown in New Hampshire is \$28,250. The additional estimated value of sweetpotatoes planned to be grown using our results in Maine, Vermont and Massachusetts is \$145,950. Further, growers will reduce costs by \$6,000 through the use of appropriate season extension technologies. We estimate that New Hampshire, Maine and Vermont home gardeners will grow this crop for the first time in 2009 using the research results we disseminated, which will contribute to a healthy local food system and increased food self-sufficiency. Eight growers learned about and planted trial crops of winter sprouting broccoli this year as a result of this work.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 205 | Plant Management Systems |
| 202 | Plant Genetic Resources |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 204 | Plant Product Quality and Utility (Preharvest) |

Outcome #14**1. Outcome Measures**

Increase knowledge of introduced and invasive marine plants

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|-------------|----------------------------|---------------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

The status and potential impacts of introduced and invasive marine plant species are important to current and future uses of marine resources.

What has been done

Historical and recent floristic studies, rapid assessment surveys and molecular investigations were used to evaluate the occurrence of 20 seaweeds introduced to the northwest Atlantic ocean. Taxonomy and phylogeography of populations of the red seaweed genus *Porphyra* were quantified and the ecological impacts of introduced Asian species assessed at several locations in New England.

Results

This led to the discovery of several previously unknown species, and has helped transform the global understanding of this large and important group of seaweeds. The work will ultimately lead to a major taxonomic revision of the entire Order.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|----------------|--|
| 206 | Basic Plant Biology |
| 136 | Conservation of Biological Diversity |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |

Outcome #15

1. Outcome Measures

Produce new functional food products that directly improve human health and wellbeing.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Incidence of human health and disease problems is increasing in the U.S. Many of these are related to nutrition and eating habits. Agricultural research is critical to providing producers with profitable new products that will improve the health and wellbeing of consumers.

What has been done

Carotenoids are known factors in preventing macular (eye) diseases. UNH is working in the field of 'functional foods' to combine vegetable development with specific human nutrition and health needs. We funded collaborative research between a vegetable breeder and a food and nutrition scientist to address this issue.

Results

We determined an efficient methodology for extracting carotenoids from squash tissues and will be identifying types of carotenoids in germplasm that we previously identified as having good carotenoid content and are therefore potential sources of nutritionally important carotenoids. We are also determining the association between carotenoid levels and eating quality at different harvest periods and storage times. This information further directs selection of breeding lines for developing new hybrid varieties with both superior nutritional value and eating quality. Producers receive superior varieties having potentially greater market value, along with specific directions to maximize harvest and storage. Consumers receive foods that are more delicious and that simultaneously improve their health and quality of life.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 202 | Plant Genetic Resources |
| 204 | Plant Product Quality and Utility (Preharvest) |
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 205 | Plant Management Systems |

Outcome #16**1. Outcome Measures**

Develop new and improved varieties of vegetable crops.

2. Associated Institution Types

•1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

| Year | Quantitative Target | Actual |
|------|---------------------|--------|
| 2008 | {No Data Entered} | 0 |

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Local retail marketing is the primary venue for vegetable agriculture in New England and continued profitability of local vegetable farms is dependent on providing higher quality and more nutritious produce than that generally available through large retail outlets.

What has been done

The New Hampshire AES continues to be a leader in developing new varieties with improved eating quality and nutrition, along with better disease resistance to reduce pesticide inputs.

Results

UNH has released more than 40 new vegetable varieties during the past 10 years, and annual seed sales of UNH-developed varieties bring in more than \$1.5 million dollars to seed companies, including several local companies in the Northeast. Highlights for 2009 include the introduction of 'Honey Bear' a high quality acorn squash with powdery mildew resistance, 'Slick Pik'tm YS26, a spineless yellow summer squash with markedly improved harvest quality, and 'Moonshine' pumpkin, the first moderately large white jack-o-lantern pumpkin with a strong handle.

4. Associated Knowledge Areas

| KA Code | Knowledge Area |
|---------|--|
| 201 | Plant Genome, Genetics, and Genetic Mechanisms |
| 205 | Plant Management Systems |
| 136 | Conservation of Biological Diversity |
| 204 | Plant Product Quality and Utility (Preharvest) |

V(H). Planned Program (External Factors)**External factors which affected outcomes**

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

Brief Explanation**V(I). Planned Program (Evaluation Studies and Data Collection)****1. Evaluation Studies Planned**

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}