Annual Report of Accomplishments and Results
October 1, 2004 to September 30, 2005

NEW HAMPSHIRE AGRICULTURAL EXPERIMENT STATION

COLLEGE OF LIFE SCIENCES AND AGRICULTURE

UNIVERSITY OF NEW HAMPSHIRE
DURHAM, NEW HAMPSHIRE

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INTRODUCTION

The New Hampshire Agricultural Experiment Station (NH-AES) resides within the University of New Hampshire College of Life Sciences and Agriculture. It has the responsibility for the Hatch, McIntire-Stennis, Animal Health, and Multi-State Research Programs. This report of accomplishments does not include New Hampshire Cooperative Extension, which is a separate administrative unit in New Hampshire. However, there is effective coordination of appropriate programs among both units. Through the NH-AES Advisory Committee representing key stakeholder groups, we are working to facilitate constituent input and to improve our delivery of research findings to end users.

A. Planned Programs

Goal 1: An Agricultural System that is Highly Competitive in the Global Economy

Issue
Provide both basic and applied research to support increased knowledge to improve production, marketing and processing of American agricultural products.

Overview:
The New Hampshire AES has established as an outcome indicator increasing the effectiveness of basic and applied projects related to New Hampshire (NH) agricultural needs. Additionally, we use the increase in agricultural production in New Hampshire and income growth to New Hampshire farm operations as indicators. Based on the most recent data available from the USDA's New England Agricultural Statistics Service*, the value of crop production increased from 94.3 million in 2003 to 96.2 million in 2004 in New Hampshire. In NH, the value of livestock production increased from $63.4 million in 2003 to $75.4 million in 2004. Between 2003 and 2004, the revenue from services and forestry in NH increased from $37.7 million to $42.6 million. Between 2003 and 2004, the agricultural sector contribution to the State's Economy increased from $195.4 to $ 213.3 million. In NH, between 2003 and 2004, the net farm income increased from $31.9 million to 36.7 million. The January 1, 2005 New England farm real estate value, including land and buildings, averaged $4,260 per acre, up six percent from the previous year. New Hampshire average value per acre of farmland and buildings increased from $3,100 per acre in 2003 to $3,450 per acre in 2005.

We continue our philosophy that the mission of the Agricultural Experiment Station is greater than solely enhancing production agriculture and thus support basic and applied sciences that help position NH to 1) develop new agricultural products and jobs, 2) augment farm-based and farm-related industry, 3) provide opportunities for non-traditional farming endeavors, and 4) create opportunities for farm and rural community development. Each of these areas contributes to the development of a highly competitive and sustainable agricultural system for the global market.

(*) Sources: New England Agricultural Statistics, 2005

The NH Agricultural Experiment Station supports the following basic and applied projects within Goal 1 to create technology and research for the benefit of the state, region and nation. We believe these projects provided valuable results, excellent return on the investment of AES funds, and a strategic position for the NH AES to successfully achieve the five year POW goals.

Key Theme - Animal Production Efficiency

1. Improve supply of nutrients to dairy cows

a. Brief description of the activity

Two projects are devoted to improving the efficiency of conversion of feed protein to milk protein that is fundamental to both environmental and economic sustainability of the US dairy industry. One experiment was initiated that examines the effects of providing a mixture of essential oils on efficiency of use o dietary N by rumen microbes. Forty Holstein cows were assigned to a randomized block design according to expected date of calving. Treatments (control and VERTAN) were initiated 21 days after calving and are being continued through 105 days postpartum. Primary measurements include feed intake, milk yield, and milk composition. This experiment is in progress. A second experiment was initiated and in progress to identify rapid and reliable laboratory methods that can be used to obtain accurate estimates of RUP digestibility and digestibility of lysine in RUP. In the second project, an experiment was conducted to determine the effects of feeding graded amounts of RP-Met to lactating cows fed Met-deficient or Met-adequate diets on plasma Met and milk protein concentrations. Forty lactating Holstein cows were used in a replicated, complete block, split plot 5 x 5 Latin square design with a 2 x 2 x 5 factorial arrangement of treatments. There were no effects on milk protein concentrations when Smartamine M or MetaSmart were added to the Met-adequate diets. However, milk protein concentrations increased when graded amounts of Smartamine M or MetaSmart were added to the Met-deficient diets, confirming that Met-deficient and Met-adequate diets had been established. It is concluded thus far from these results that using changes in milk protein concentrations to estimate Met bioavailability values for Met supplements is not as precise as using changes in plasma Met concentrations, and that more research is needed to determine the best response criteria for determining efficacy of Met analogs.

b. Short Impact/Accomplishment Statement

The protein research provides information that is needed for more precise formulation of dairy cattle diets for protein. More precise feeding of protein increases the conversion of feed nitrogen to meat and milk protein, decreases feed costs, and reduces the potential for nitrogen pollution.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $ 67,800
	State- 154,493
	Total – 222,293
Full-time equivalents:	Sci. 0.4; Prof 0.7; Tech 1.0; Total 2.1

d. Scope of impact: Multistate; Integrated Research and Extension Project 1 - (AL, AZ, CA-

Davis, ID, IL, IN, IA, J.D.. Heiskell & Co., KS, KY, MD, MI, MN, MO, NH, ND,OH, PA, SD, USDA-ARS/WI, UT, VA Tech, WA, WI,).

Project 2: Multistate; Integrated Research and Extension (AZ, CA-Davis, FL, GA, IN, IA, KS, KY, LA, MD, MI, MN, NE, NH, NY-Cornell, OH, PA, SD, TX, UT, VT, VA Tech, WI).

2. Predicting bovine fertility

a. Brief description of the activity

Pregnancy losses in cattle during the late embryonic and early fetal period are an economic concern to the cattle industry. Three independent NH projects contribute to understand ovarian function relative to late embryonic/early fetal mortality in cattle and to determine if environmental/metabolic stressors affect fertility as well as embryonic/fetal survival. Specifically, one study is examining the effects of the environment on the corpus luteum function by examining the relationship between heat stress and the expression of heat shock proteins. Another study is examining the diversity of the microvasculature within the corpus luteum by examining the role of prostaglandin. Considering that prostaglandin remains the most widely used hormone in the livestock industry to induce luteal regression, furthering our understanding of the cellular actions of PGF within the corpus luteum could lead to new methods of regulating ovarian function and fertility. The third project is examining Fas targeting on the cell surface and the intracellular regulation of Fas-mediated events in ovarian steroidogenic cells. To date, the data in luteal cells shows an inverse relationship between the extent of CK8/18 filament expression and relative susceptibility of the cells to Fas ligand-induced apoptosis.

b. Short Impact/Accomplishment Statement

Elucidating the mechanisms by which heat stress and the expression of heat shock proteins affect ovarian function may provide insight toward understanding the lower fertility rates and how heat shock proteins may mediate prostaglandin F2 alpha action in the regulation of reproductive cycles. Since sub-normal ovarian function contributes to early embryonic death, this may lessen the economic loss to producers. Fundamental knowledge of the cellular and molecular mechanisms of Fas ligand-induced apoptosis in granulose and luteal cells is an important aspect to the formulation of methods to improve regulation of ovarian function and potentially improve fertility.

c. Source of funding/total expenditures/full time equivalents (for 2 projects)

Source of funding:	Hatch
Total expenditures:	Federal – $57,451
	State- 68,510
	Total – 125,961
Full-time equivalents:	Sci. 0.6; Prof 0.6; Total 1.2

d. Scope of impact: Multistate Research (CT-Storrs, MA, NH, NY-Ithaca, OH, PA, WV)

3. Improving nutrition for dairy calves

a. Brief description of the activity

Lactoferrin, a milk protein, has antibacterial, antiviral, and growth promoting activity.

Ongoing research continues to examine supplementation of milk replacer with 1 g/d lactoferrin. To date the results of one study indicated there is no benefit to supplementing calves with lactoferrin. The second study investigated the effect of lactoferrin on intestinal epithelial development in milk fed calves and the effect of lactoferrin on IgG uptake. Results suggested that lactoferrin may improve IgG uptake, but has little effect on intestinal epithelial development.

b. Short Impact/Accomplishment Statement
Lactoferrin may enhance IgG uptake in the neonatal calf and thus increase intestinal development resulting in more efficient nutrient use and healthier calves. This is critical to the health of the newborn dairy calf because they are born agammaglobulinemic. Enhancing the uptake of IgG should improve the health of the calf and reduce medical costs for the dairy producer.

c. Source of funding/total expenditures/full time equivalents
Source of funding: Hatch
Total expenditures: Federal - $22,112
State- 29,035
Total – 51,147
Full-time equivalents: Sci. 0.4; Prof. 0.5; Total 0.9

d. Scope of impact: Multistate; Integrated Research and Extension **(**AZ, CA-Davis, FL, GA, IN, IA, KS, KY, LA, MD, MI, MN, NE, NH, NYC, OH, PA, SD, TX, UT, VT, VA Tech, WI)

4. Enhancing Efficiency with Equine Semen
a. Brief description of the activity
The impact of prepackaging extended equine semen in straws at room temperature prior to cooling to 5C is being evaluated. Preliminary experiments demonstrated that the conventional (control) cooling rate could be duplicated by placing straws containing extended semen in 450 ml of room temperature water in a glass vessel that in turn is placed in a refrigerator for cooling. When cooled by this method, the straws containing the extended semen simply need to be removed from the water after cooling to be dried and placed on the freezing rack before transfer to nitrogen vapor for freezing. In addition to this, a container was devised for cooling semen that had been pre-packaged in straws and pre-loaded on the actual freezing rack. Preliminary studies show that the cooling rate resulting with this method was virtually identical to that with the control method. An experiment is now underway to assess the impact of these different cooling methods on sperm survival during freezing.

b. Short Impact/Accomplishment Statement
The ability to package extended stallion semen in straws prior to cooling will offer greater convenience and better temperature control for semen processors who do not have access to a cold room.

c. Source of funding/total expenditures/full time equivalents
Source of funding: Hatch

Total expenditures: Federal - $25,007
State- 52,657
Total – 77,664
Full-time equivalents: Sci. 0.4; Total 0.4

d. Scope of impact: State Specific

5. Lobster habitats and survival

a. Brief description of the activity

The primary goal of this project is to use a combination of telemetry techniques to track individual American lobsters moving freely in their natural habitat. In particular, this project aims to determine if the home range of a lobster is related to its size or sex, and whether the size of a lobster home range varies depending on the habitat. In the first study completed, a total of 11 lobsters were tracked off of New Castle Island. 4 days of satisfactory data were collected from 6 of the 11 lobsters tagged and these were tracked an average of 11.8 days. Further studies will continue to assess the telemetry techniques to track lobsters in their natural habitat.

b. Short Impact/Accomplishment Statement

The American lobster fishery is one of the most valuable fisheries in New England and there is considerable concern about how this fishery can be made sustainable despite heavy exploitation. This study will provide valuable data about the movement patterns of lobsters and the types of habitats they prefer at different times of the year. This type of information is necessary in order to effectively manage the resource so that commercial fishermen can make a good living without depleting the natural resource.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $35,195
State- 115,438
Total – 150,633
Full-time equivalents: Sci. 0.6; Prof. 0.8; Total 1.4

d. Scope of impact: State Specific

6. Oyster and Mussel habitats

a. Brief description of the activity

This project is assessing experimental reefs to increase the production and restoration of oysters and mussels. Data were collected from multiple experimental oyster reefs in two major experimental areas. Natural recruitment rates were monitored in three areas using shell bags elevated above the bottom; data from this experiment indicated that spat sets on experimental substrates were at greater rates than on natural oyster reefs. This finding is being considered in the context of the potential for harvesting natural set to complement the ongoing remote setting efforts.

b. Short Impact/Accomplishment Statement

This project is designed to provide information useful to the State of New Hampshire in meeting its goal of restoring 8 hectares of oyster reef bottom by the year 2010. In addition to impacts at the state level, the results of this research have been and will be reported at national and international conferences. It is expected that future, full-scale reef restoration projects in New Hampshire (and elsewhere) will incorporate the findings of these studies.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $9,542
State- 17,250
Total – 26,792
Full-time equivalents: Prof. 0.4; Total 0.4

d. Scope of impact: State Specific

Key Theme - Animal Health

1. Genetic bases for resistance to avian diseases

a. Brief description of the activity

Ongoing research focuses on the immunogenetics of retroviral and oncogene tumor regression. Major histocompatibility *B* complex (MHC) genes, which govern immune responses, control tumor outcome, either regression or progression. A new MHC recombinant was found in the tenth backcross generation for R1 and tested for immunity. The results indicate that the R13 recombination event did not involve genes affecting the antibody response. Utilizing congenic chicken lines, which differ only by their *B* complex genes, B^1B^2 and B^2B^2chickens had significantly lower tumor profile index than did the B^1B^1 genotype.

b. Short Impact/Accomplishment Statement

Poultry health will be improved by greater understanding of the genes that affect avian immunity. Improved health represents a substantial economic benefit to poultry breeders and producers.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $35,977
State- 101,322
Program Income - 392
Total – 137,691

Full-time equivalents: Sci. 0.3; Tech. 1.0; Total 1.3

d. Scope of impact: Multistate Research (AL, AR, CA-Davis, DE, IA, MS, NH, NY-Ithaca, NC, SC, TX).

2. Causes of soft shell clam decline

a. Brief description of the activity

Normal and leukemic hemocytes from the soft-shell clam, Mya arenaria, were used to investigate wild type clam p53 and clam mortalin proteins before and after treatment with MKT-077 (cationic inhibitor of mortalin) using immunocytochemistry, co-immunoprecipitation and sub-cellular localization. Using co-immunoprecipitation, clam p53 and clam mortalin were bound together in the cytoplasm of leukemic but not in normal hemocytes. Results also showed that MKT-077 disrupts the interaction of mortalin and p53 proteins resulting in translocation of some Map53 protein from the cytoplasm to the nucleus and ultimately in apoptosis of LCH. From these data, it is suggested that Map53 is tethered in the cytoplasm of leukemic hemocytes by clam mortalin in a fashion similar to that seen for p53 and mortalin proteins in a number of unrelated human cancers.

b. Short Impact/Accomplishment Statement

These studies of clam leukemia have led to a thorough understanding of a commercially important bivalve disease. Many commercially important bivalves such as blue mussel, and quahogs display a phenotypically similar blood disease. Thus, this information that is obtained from these studies should have importance 1) in environmental monitoring efforts to determine the extent of this disease in environmentally impacted sites and 2) in efforts to develop methods for treating important seed clam populations. In addition, clam leukemia can serve as in important model for studies of human cancers with a similar mortalin generated phenotype.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $24,778
State- 68,231
Total – 93,009
Full-time equivalents: Sci. 0.3; Prof 0.5; Total 0.8

d. Scope of impact: State Specific

Key Theme - Plant Production Efficiency

1. Development of Components for Greenhouse Production System

a. Brief description of the activity

This work involves three topics/objectives 1) Young Plant Center that focuses on floriculture production, breeding, pathology of vegetatively-propagated plants; 2) surveying physical and chemical qualities of commercial propagation media; and 3) publishing the Lighting Up Profits book. There are several ongoing projects to meet these objectives including developing new soil testing methods, optimizing humidity and mist levels; management of disease and pests that are very dependent on moisture level; quantifying lime reactivity and residual lime in container media, quantifying tissue and media nutrient levels from the stock plant stage through to propagation for vegetatively-propagated cuttings; and presenting workshops on greenhouse energy efficiency. Research on photosynthesis of scaevola, and

production program for cut flower poinsettia was completed. Approximately 60 breeding lines were evaluated in field and greenhouse trials during summer 2005, and four lines ere provided for industry trials. Approximately 100 Nolana interspecific hybrids were also evaluated during summer 2005 and ten lines were provided for industry trials.

b. Short Impact/Accomplishment Statement
The decision-support systems developed by UNH allow growers to reduce chemical use (fertilizer, growth retardants, and pesticides) by tracking actual versus optimum production levels and are used by 200 growers. Twenty-one universities are using these systems to train new growers in an integrated, scientific approach to crop management. Unique training resources have been developed with 2100 copies (nutrition) currently in use. Traditional (articles, seminars) and innovative (web-based, active-learning) technologies are being used to train growers in improved fertilizer management and lighting energy management methods. Sales of Anagallis "Wildcat Blue" and "Wildcat Orange" developed at UNH surpassed 300,000 cuttings on their third year of sales. Presentations were made to 14 leading companies, who ranked the industry value of 15 areas of this project. The project included several onsite trials and collaborations with six greenhouse firms in NH, NH, and CO.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $93,431
	State – 57,639
	Program Income - 7,536
	Total – 158,606
Full-time equivalents:	Sci. 0.3; Prof 0.6; Total 0.9

d. Scope of impact: Multistate; Integrated Research and Extension (AZ, CTH, GA, KY, NE, NH, NJ, NY-Ithaca, OH, PA, TX)

2. Genetics and breeding of Cucurbita
a. Brief description of the activity
Premature harvest of acorn squash is a widespread problem because fruits reach maximum size and optimum color within 20 days after pollination. This research is examining the optimum harvest period of Cucurbita pepo squash. In the summer of 2004, C. pepo squash cultivars were evaluated at three harvest dates, 25, 35 and 45 days after pollination, with or without a 0 day storage period at 21C. Data were collected on mesocarp dry weight, Brix levels and partitioning of biomass between mesocarp tissues and developing embryos during storage periods. From the results of these studies, it is recommended that growers maintain healthy plants until 45 to 50 days after pollination. For maximizing flesh dry matter and attaining sufficient Brix levels in most acorn cultivars, especially those with low mesocarp dry matter, it is recommended that harvesting of squash be delayed until at last 45 days after fruit set.

b. Short Impact/Accomplishment Statement
Investigations of harvest time and eating quality in acorn squash conducted in 2003, 2004, and 2005 demonstrated that premature harvest of squash (prior to 45 days after fruit et)

reduces eating quality substantially in most cultivars. The reduction in eating quality with early harvest is due to insufficient sugar levels, and to reallocation of assimilates from edible flesh to developing seeds.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $18,051
	State- 38,122
	Total – 56,173
Full-time equivalents:	Sci. 0.2; Total 0.2

d. Scope of impact: Integrated Research and Extension; State Specific

3. Small fruit production in modified environments

a. Brief description of the activity

Current matted row strawberry culture requires excessive inputs of labor and chemical weed control agents. The harvest period in this system is short, and is susceptible to weather extremes. Growth chamber and field high tunnel cultural system experiments were conducted with strawberry plants. Preliminary growth chamber experiments showing that floral initiation and development of early emerging flowers in cv Chandler can be arrested by day-length extension was not replicable in high tunnels in the field. Day length extension thus does not appear to be a feasible technique for increasing berry size for early market strawberries in NH.

b. Short Impact/Accomplishment Statement

The combination of either row-covered raised bed or high tunnel cultural systems with strawberry cultivars has been shown to be effective for production of premium sized berries significantly earlier in the season than traditional matted row or raised bed cultural systems alone. Maximizing primary and secondary berry size by proper cultivar selection and promoting earlier berry maturity with either row covers applied to raised bed or high tunnels enables NH growers to add early large, high, quality, locally grown strawberries to the list of loss-leaders with potential for attracting customers to direct-markets.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $20,527
	State- 57,877
	Program Income – 3,840
	Total – 82,244
Full-time equivalents:	Sci. 0.4; Prof. 0.1; Total 0.5

d. Scope of impact: Integrated Research and Extension; state specific

4. Conservation of plant genetic resources

a. Brief description of the activity

Several new kabocha/buttercup hybrids from the New Hampshire AES breeding program

have been evaluated over the past ten years. The primary objective has been to breed varieties with more restricted vine growth and that have eating quality acceptable for both the North American and global markets, especially Japan. As a result of these efforts, two new varieties, Thunder and Eclipse, have been introduced for commercial sale in the 2006-growing season. Another New Hampshire breeding program has sought to improve disease resistance in early maturing cultivars of cantaloupe and related melons. As a result of these efforts and cooperative arrangements with seed companies, seven new hybrid cultivars, Goddess, Diplomat, Visa, Maverick, Halona, Strike and Sensation are being introduced into the seed trade for 2006 All of these varieties carry resistance to the common races of powdery mildew.

b. Short Impact/Accomplishment Statement
Two new cultivars of kabocha squash, Thunder and Eclipse, have restricted vine growth (semi-bush growth habit) and a more uniform growth habit, resulting in rapid canopy development for improved weed control. Five of the new melon hybrids released by the NHAES, Halona, Maverick, Goddess, Diplomat and Visa, are both early maturing and have improved disease resistance over other popular early-season varieties, thus reducing inputs of pesticides. The two new early maturing cultivars of spoon (Koshare) and egg gourd (Goblin) developed at the NHAES can be grown in short-season regions and give growers a new fall ornamental crop that should appeal to consumers.

c**.** Source of funding/total expenditures/full time equivalents
Source of funding: Hatch
Total expenditures: Federal - $16,307
State- 35,395
Total – 51,702
Full-time equivalents: Sci 0.2; Total 0.2

d. Scope of impact: Multistate; Integrated Research and Extension (CT-New Haven, DE, MA, ME, National Germplasm Resources Laboratory, NH, NJ, NY-Geneva, NY-Ithaca, PA, RI, USDA/ARS)

5. Role of UVB effects on Plants
a. Brief description of the activity
This project will help determine how UVB is detected by the plant as a prelude to responses to changes in UVB as a normal part of the environmental signaling system in plants. The high CO2 and low CO2 plus UVB experiments have been done. Data collecting and data analysis on these experiments will be completed by Fall 2006.

b. Short Impact/Accomplishment Statement
The results of this study will add to a growing body of knowledge on possible roles redox state changes in chloroplasts play as part of the pathway cells use to detect changes in their environment. The results of these experiments will provide information on whether the rate or efficiency at which the Calvin/Benson cycle runs will have an effect on the UVB induced shade response in Sunflower leaves.

c. Source of funding/total expenditures/full time equivalent

Source of funding: Hatch
Total expenditures: Federal - $17,538
State- 51,114
Total – 68,652
Full-time equivalents: Sci. 0.3; Prof. 0.2; Total 0.5

d. Scope of impact: State Specific

6. Nutrient management for woody and perennial plants

a. Brief description of the activity

The appropriate use of fertilizers has economic and environmental implications. Nitrogen is an effective way to enhance growth; however, it has the potential to leach into ground water. Excess phosphorus contributes to surface water degradation. This project examines nitrogen, and phosphorus fertilizer management practices for woody and perennial landscape plants. It is intended to improve nutrient use efficiency and prevent excess nutrients in the environment. One trial in which responses to nitrogen rate and time of application was completed testing three species (Viburnum, Syringa, and Fraxinus). Syringa vulgaris showed the greatest response to nitrogen fertilization, with nearly all dependent variables showing significant responses. Contrasts to test the effects of time of application showed that April was a critical time for fertilization of Syringa. Two small replicated experiments were established in spring 2004 and repeated in 2005 to test the response of newly planted trees to phosphorus. It will take 2 to 3 years before any conclusions can be made from the data being collected.

b. Short Impact/Accomplishment Statement

Nitrogen and phosphorus inputs can potentially be reduced in field nurseries and landscapes without limiting growth and health of plants. Timing nutrient applications to periods of crop uptake is an important strategy for reducing the total amounts applied. These data show that plant species differ in their response to nitrogen rate and time of application. Woody nursery crops should be screened for response type and put in management groups to reduce unnecessary nutrient applications.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $13,713
State- 26,371
Total – 40,084
Full-time equivalents: Sci. 0.3; Total 0.3

d. Scope of impact: Integrated Research and Extension; State specific

7. Development of Nutrient Management

a. Brief description of the activity

Certain soil chemical characteristics and agricultural management practices can contribute to an increased risk of offsite nutrient movement. Several field studies were conducted to

evaluate the nutrient credit contributions from previous crops (sod) to corn silage, winter squash and ornamentals. Assessing yield, the results showed that no additional nitrogen was needed for squash and corn. Preliminary use and evaluation of chlorophyll meters as a potential replacement for the soil nitrate test (PSNT) indicated that there was sufficient N available for the crop at the 6-8 leaf stage and the stalk nitrate test (end of season) confirmed the presence of sufficient N in the system at harvest time. These efforts will be continued and expanded in the next growing season.

b. Short Impact/Accomplishment Statement
Demonstrating that nitrogen for crops can come from many sources including the prior crop, soil organic matter and the soils themselves, will help farmers grow crops in a manner that is more environmentally sound. The use of the chlorophyll meter and stalk nitrate test to evaluate the nitrogen status of the plant at the 6-8 leaf stage and again at harvest, will provide the data to help farmers make the required decisions.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $6,338
	State- 0
	Total – 6,338
Full-time equivalents:	Total 0.0

d. Scope of impact: Integrated Research and Extension; State specific

8. Strengthening Sustainable Local Food Systems

a. Brief description of the activity
The work of NE-1012 has continued on the following projects 1) NH Farm to School Program, which brings NH apples and cider to over half the schools in the state and offers related curriculum and educational opportunities continued to develop as a farm-to-school model and 2) reports of progress was presented at the 2nd National Farm to School Conference, Farm-to-College and institutional purchasing was also advanced through the UNH Local Harvest Dinner. This work also resulted in a successful planning grant to produce a strategic plan for the NH Center for Food Security; planning will be completed by June 06. Efforts also continued on the establishment of the UNH Organic Dairy Research Farm, including collaboration with the University of Maine. The farm will be the first organic research dairy at a land grant in the US and will provide urgently needed support to dairy farmers in the region.

b. Short Impact/Accomplishment Statement
NE 1012 continued to demonstrate clear, practical solutions for strengthening local food systems economically and nutritionally. In addition, NE 1012 efforts have played a key role in building a long-term research capability in the region to support dairy farmers. NE1012 also provided leadership in these critical areas that has helped strengthen national farm-to-school, nutrition and organic dairy research efforts.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal – $9,362
State-
Total – 9,362
Full-time equivalents: Sci. 0.0; Prof 0.0; Total 0.0

d. Scope of impact: Multistate; Integrated Research and Extension (CA-Davis, KS, ME, MA, MI, MN, MO, NH, NJ, NY-Ithaca, OR, PA, PR, VT, WA, WV, WI)

Key Theme - Plant Health

1. Inhibition of photosynthesis by UV-radiation

a. Brief description of the activity

The work this past year has focused on studying the effects of ultraviolet-B (UV-B) radiation in chloroplasts. A major technical difficulty has arisen in that the UV-B spectrum of solar radiation is nearly impossible to replicate in the laboratory. UV-B emitting lamps unavoidably emit UVA and UV-C radiation. Thus a new method was developed to remove the UV-A and UV-C contamination using a liquid potassium chromate filter, which permits a more direct assessment of the effects of UV-B exposure. Based on the various experiments that were completed, the chromate system more closely mimics solar UV radiation than traditional methods.

b. Short Impact/Accomplishment Statement

Since half of the world's photosynthesis occurs in the oceans by microscopic algae, the effects of changing UV radiation may have major effects on photosynthesis and thus ocean productivity.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $18,080
State- 58,412
Total – 76,492
Full-time equivalents: Sci. 0.3; Prof. 0.3; Total 0.6

d. Scope of impact: State Specific

Key Theme - Plant Genomics

1. Molecular biology of seed coat development in pumpkin

a. Brief description of the activity

Although the technology of artificial seeds has made significant advances, there is still little known about the development of seed coat. A comparative study of molecular changes during development of seed coasts was undertaken in wild type and a recessive hull-less mutant of pumpkin (Cucurbita pepo L.) with the goal of identifying key genes involved in secondary cell wall development in the testa. The expression patterns of several genes were determined. These genes are involved in secondary cell wall biosynthesis during the development of testa. The results showed a coordinated expression of several genes involved

in cellulose and lignin biosynthesis as well as marked differences in the level of their expression between the two genotypes during testa development. There is generally a higher expression of genes involved in cellulose and lignin biosynthesis in the wild type testa as compared to the mutant.

b. Short Impact/Accomplishment Statement
An understanding of the genes involved in cell wall development in the testa will facilitate the manipulation of seed coat development in Cucurbita and other species for diverse commercial applications. Information about cell wall biochemistry will also aid in experimental modification of the secondary cell wall in seeds to increase their storage characteristics and their resistance to infection.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $18,570
	State- 29,609
	Total – 48,179
Full-time equivalents:	Sci 0.2; Prof. 0.2; Total 0.4

d. Scope of impact: State specific

2. Expression of Arabidopsis genes under Normal and Stress Conditions

a. Brief description of the activity
The focus of this research is to elucidate how levels of calcium-dependent protein kinases (CDPKs) differ between different plant organs and upon stress treatment. Semi-quantitative RT-PCR was used to measure gene expression. In studies to date, it has been shown that most of the 21 CDPKs that were tested were expressed in either 14-day old seedlings or in roots, although expression of two of the genes could only be detected in open flowers. During the course of the experiments, microarrays containing most of the Arabidopsis genes became available as research tools for conducting global studies on transcriptional profiling. An in silico analysis of Arabidopsis gene expression was done and shown that at least nine Arabidopsis genes are predominantly expressed in stamens, most likely in pollen. The data from the in silico analysis were consistent with the RT-PCR experiments.

b. Short Impact/Accomplishment Statement
CDPKs are important for correct plant responses to drought stress, pathogen attack, wounding, etc. Identifying where and when plants express CDPK genes is critical for understanding how these proteins participate in signal transduction. The results of this research can be applied to future studies on crop plants.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $18,130
	State- 60,083
	Total – 78,213
Full-time equivalents:	Sci. 0.3; Prof. 1.0; Total 1.3

d. Scope of impact: State Specific

4. Genomic tools for strawberry

a. Brief description of the activity

Several genomic tools were initiated and/or developed as a basis for connecting specific genes to specific traits in the strawberry. The following are a couple of examples of some of the ongoing research. From the genomic library, the complete regulatory region of the flavanone 3-hydroxylase gene (proposed to be involved in the control of fruit color variation) has been isolated and efforts are underway to characterize the allelic variation. A linkage association between the runnerless trait in F. vesca and a candidate gene has been established and attempts are now being made to isolate a complete genomic copy of this gene from a fosmid clone. In mint, a genomic sequence flanking an initially isolated segment of a putative mint homologue has been obtained by inverse PCR. This is the homologue of the tomato Ve gene for resistance to verticillium wilt. The alleles are being examined to assess their potential association with disease susceptibility.

b. Short Impact/Accomplishment Statement

The EST and genomic sequence resources that have been generated provide a basis for developing gene-based molecular markers for use in identifying linkage associations between candidate genes and traits of economic interest, and can also be implemented as tools for marker assisted selection once such associations have been identified. Some of the traits of economic significance as targets for molecular marker development are plant growth habit, flowering habit, and disease resistance. The mint research contributes to a needed effort to overcome the industry wide problem of Verticillium wilt susceptibility in the cultivated mints, by isolating a fully functional verticillium resistance gene that may provide significant potential benefit if introduced into commercial peppermint.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $27,048
	State- 68,458
	Total – 95,506
Full-time equivalents:	Sci. 0.4; Prof 0.7; Total 1.1

d. Scope of impact:

Key Theme - Aquaculture

1. Genetic improvement of tilapia for aquaculture

a. Brief description of the activity

There are two major projects. The first project is ongoing and is focused on the development and use of genetic maps to study commercially important traits in tilapia. Full-length, normalized cDNA libraries for tilapia have been constructed using the SMART technology to produce cDNAs with complete 5’ ends, and a duplex-specific nuclease from the Kamcatka crab. The crab enzyme is used to degrade rapidly hybridizing components of a cDNA

mixture, reducing the representation of highly expressed genes. Using this approach, cDNA libraries were constructed from seven tilapia tissues (brain, heart, kidney, gill, retina, lymphocyte, stimulated lymphocytes). Average insert sizes in these libraries range from 800-1000bp. The genes identified were the typical genes for that tissue can be viewed at http://hcgs.unh.edu/blast/. In the second project, ongoing work is focused on the development and evaluation of tools for clustering and comparative analysis of DNA sequence data from fish. A first experiment was performed and 10 Mb of tilapia cDNA was sequenced. These ESTs were clustered and are displayed on the genome sequence of Tetradodon (http://hcgs.unh.edu/gbrowse/).

b. Short Impact/Accomplishment Statement

These cDNA libraries are immediately useful for the construction of microarrays for studies of gene expression in response to environmental and disease stress. They also form the starting material for sequencing expressed sequence tags, which are essential for interpretation and annotation of complete genome sequences. Together these tools will help identify genes regulating important commercial traits in tilapia, including growth rate, disease resistance, and control of sexual differentiation. Assembled genomic and EST sequences are the foundation upon which genomic approaches to functional biology are built. The sequence resources we are assembling are proving useful in the positional cloning and identification of genes underlying sex determination and skin color in tilapia.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $34,834
State- 64,954
Total – 99,788
Full-time equivalents: Sci. 0.3; Prof. 0.6; Total 0.9

d. Scope of impact: Multi-state Research (AL, Animal Health Trust UK, AR, Beltsville Area, CA-Davis, City of Hope National Medical Ctr., DE, Equine Research Institute, Fort Valley State Univ., HI, INRA, IN, IA, KY, LA, MD, Medical University SC, MI, MN, National Marine Fisheries Service/NW Fisheries Science Ctr., NE, NV, NH, NJ, NM, NY-Ithaca, North Atlantic Area, NC, OK, RI, Shelterwood Laboratories, SC, Stormont Laboratories, Inc., TX, Tufts Univ. School of Veterinary Medicine, USDA, ARS, USDA-ARS-Avian Disease & Oncology Lab, USDA-ARS/Oregon, Univ. British Columbia, Univ. Cincinnati Medical Ctr., SC, UT, WA, WI

2. Increased efficiency of producing sea urchins

a. Brief description of the activity

Declining wild harvests of green sea urchins in the Gulf of Maine will require hatchery systems for both stock enhancement and aquaculture. Hatchery construction was completed in 2005 with the addition of a recirculating tank system with chiller for maintaining juvenile urchins for out planting and also brood stock. Three spawnings led to successful production o juvenile urchins, which were used for out planting to lease sites and for growth studies. As in past trials, growth variation among cohorts of juvenile urchins remains a problem, but some urchins reached 26 mm in test diameter within eight months, suggesting that selection

experiments for fast growth are feasible within the annual reproductive cycle of the green sea urchin.

b. Short Impact/Accomplishment Statement
Continued successful hatchery operation further demonstrated the reliability of hatchery production for support of aquaculture and stock enhancement. The continued decline in urchin harvests and support provided to fishermen has increased interest in sea urchin aquaculture along the Maine and New Hampshire border, with two additional lease applications pending in Maine to complement the two already in operation.

c. Source of funding/total expenditures/full time equivalents
Source of funding: Hatch
Total expenditures: Federal - $25,809
State- 58,194
Total – 84,003
Full-time equivalents: Sci. 0.3; Prof. 0.2; Total 0.5
d. Scope of impact:

3. Control of pigment production of summer flounder
a. Brief description of the activity
This project has documented and quantified the appearance of different types of pigment cells on the ocular and blind sides during larval stages and through metamorphosis. Data collected will serve to illuminate fundamental developmental progressions in larval morphology, including but not limited to the emergence of left-right differences. Attempts to clone specific symmetry-related genes from summer flounder were unsuccessful; however, during the course of this project other researchers were able to clone homologous genes from Japanese flounder.

b. Short Impact/Accomplishment Statement
The detailed data we have collected on the developmental morphology and histology of summer flounder are important to understanding the development of individual organs and tissues as well as whole-body patterning. They thus support aquaculture industry efforts to monitor and optimize flatfish development in hatcheries, and may ultimately add to understanding of how asymmetry is established in different vertebrates species.

c. Source of funding/total expenditures/full time equivalents
Total expenditures: Federal - $18,694
State- 18,624
Total – 37,318
Full-time equivalents: Sci. 0.3; Total 0.3
d. Scope of impact:

4. Taxonomy of the seaweed Porphyra
a. Brief description of the activity
The red seaweed Porphyra ("nori") is the basis of an US$1.2 billion per year industry in the world, primarily for use as human food (sushi). There is interest in establishing a nori

industry in the U.S. based on native species of Porphyra. The goal of this study is to examine the taxonomy and ecophysiology of Porphyra species native to the coast of New England. The taxonomy portion of the project has been aimed at accurately circumscribing species of Porphyra in New England. Using molecular tools to indicate species boundaries, the range of morphological cytological, and ecological characteristics of each species has been examined. In addition, an understanding of physiological tolerance and response to environmental stress is critical for matching native Porphyra species to cultivation conditions. A study was completed comparing the stress responses of two native Porphyra species to high light, desiccation and nutrient deficiencies.

b. Short Impact/Accomplishment Statement
The results of the project will facilitate the establishment of a commercial nori aquaculture industry in New England based on native species of Porphyra. It will also contribute to our understanding of the taxonomy of the species and will result in the description of an umber of new species.

c. Source of funding/total expenditures/full time
Source of funding: Hatch
Total expenditures: Federal - $22,137
State- 45,643
Total – 67,780
Full-time equivalents: Sci. 0.3; Prof 0.2; Total 0.5
d. Scope of impact:

5. Marine finfish aquaculture
a. Brief description of the activity
The purpose of this study is to develop methodology for domestication and hatchery production of Atlantic cod in coastal New Hampshire waters. Wild Atlantic cod from the winter (December) and spring (May) Ipswich bay populations were maintained in captivity and subjected to stimulated-ambient, environmental (photo-thermal) conditions for 10-month periods. It was determined that the spring-spawning Ipswich Bay population is genetically distinct from the winter-spawning population from the same location. The spring-spawning Ipswich Bay population was also found to be genetically distinct from other populations sampled.

b. Short Impact/Accomplishment Statement
The results significantly improve our capability of spawning and raising Atlantic cod and offer much needed diversification of fish farmers in the northeastern US. Genetic identification of cod stocks in US waters will ensure that locally derived broodstock are used for commercial purposes and will prevent potential genetic contamination of wild stocks.

c. Source of funding/total expenditures/full time
Source of funding: Hatch
Total expenditures: Federal - $17,589
State- 30,536
Total – 48,124

Full-time equivalents: Sci. 0.3; Prof 0.1; Total 0.4

d. Scope of impact:

Key Theme - Other

1. Genetics and Glycosylation in soil nematodes

a. Brief description of the activity

Nematodes are major causes of losses in animal and crop agriculture but can only be controlled by quarantine or resistant crop varieties. Two projects contribute to this activity. The first study is characterizing the contribution of N-glycosylation to nematode development as a prerequisite to the development of selective control methods based on species-specific glycosylation. A genome-wide screen for glycosylation-dependent loci has been initiated. The second study will enhance our understanding of agriculturally important nematodes through genetic analysis in these species. The complete genome sequence of the related nematodes C. elegans and C. briggsae is being used to identify transposon resident sites conserved between the two genomes. In addition, all available expression data are being compiled from C. elegans microarrays to identify clusters of genes that are up- or down-regulated in concert in response to developmental or other cues.

b. Short Impact/Accomplishment Statement

Using C. elegans as a model nematode, one study will identify gene-products that depend on glycosylation for proper function and determine which are nematode or species specific. This group of genes will be a set of novel targets for nematicide development through perturbation of their protein or glycan components. The second study will provide insight into the role of transposons in regulation of host gene functions in eukaryotic genomes, and the mechanism by which RNAi regulates gene expression and chromatin density. Our bioinformatic analysis of transposon distribution provides a detailed view of the genome architecture of this important model organism.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch

Total expenditures: Federal - $37,972
State- 104,214
Total – 142,186

Full-time equivalents: Sci. 0.6; Prof. 1.0; Total 1.6

d. Scope of impact: State Specific

2. Character and control of yeast regulatory interactions genes

a. Brief description of the activity.

Two projects contribute to this activity. The first study is investigating the functional and physical interactions of yeast regulatory genes to identify the factors that control gene expression. Project one analyzed the role of poly (A) binding protein (PAB1) in the control of the mRNA degradative process. The results from the experiments done for this project suggest that PAB1 integrates the transition from deadenylation to decapping and presumably from a translationally competent state to an mRNA degradative state. The second project is

analyzing the mechanisms by which a leucine-rich repeat (LRR)-containing yeast protein recognizes and binds to other proteins. Ongoing experiments include testing the ability of five of the novel peptides to bind to endogenous TLR2 express on murine bone-marrow-derived dendritic cells (BMDC) and to induce the maturation of their effector function.

b. Short Impact/Accomplishment Statement

The results are important to understanding how gene expression is controlled both in terms of synthesis and degradation. In the first study, the actions of poly(A) have been clarified in its interaction with the CCR4-NOT group of proteins; all are important regulators of protein expression in plant and animal organisms. These studies may have broad implications in understanding how protein expression can be controlled in medically and agriculturally important organisms. In the second study, the results could potentially provide researchers with novel research reagents and vaccine adjuvants, and could potentially provide the basis for development of novel therapeutic antimicrobials based on TLR-LRR-binding peptides.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $49,544
	State- 105,413
	Total – 154,957
Full-time equivalents:	Sci. 0.7; Prof. 1.1; Total 1.8

d. Scope of impact: State specific

Program Duration

The research projects that contribute to this goal are generally of three to five years duration. All projects are targeted for mid and long term problems.

In fiscal year 2005 the New Hampshire Agricultural Experiment Station had 8.7 full time equivalents of scientists time assigned to Goal 1. Their research was funded with federal funds from the Hatch, McIntire-Stennis, and Multi-State Research Programs. There were 2.0 full-time equivalents of technical and clerical staff attached to these projects. Professional help, in the form of graduate students doing research on these projects, amounted to 9.8 students. For this goal, as well as all subsequent goals, the State of New Hampshire provides matching funds through a line item within the University of New Hampshire's budget. It is not anticipated that any small changes in federal funding in the next five years would significantly alter the spectrum of key program components for Goal 1.

Goal 2: A Safe and Secure Food and Fiber System

Issue: Foods are in constant threat of contamination by microorganisms. The agricultural system has a responsibility to ensure that the foods produced are safe to eat.

Overview:

The New Hampshire AES has established output indicators for Goal 2 as follows: 1) increase research results from projects dealing with microorganisms that are potential harmful

contaminants of foods and 2) increase understanding of the processes whereby harmful microbes carry out their infective and disease-causing processes. As outcome indicators, we evaluate 1) an absence or decease of bacterial contamination of foods and 2) the level of public awareness of the contribution of pathogenic microbes to animal and human illness. We continue a philosophy that the mission of the Agricultural Experiment Station is consistent with Goal 2 and thus provide support to basic and applied sciences that help NH to 1) reduce bacterial illness, 2) determine the role of bacterial genes in diseases, 3) provide defense mechanisms against pathogenic bacteria, and 4) assess the impact of pathogenic bacteria on humans, animals and the environment. We also support programs to enhance public awareness of food safety issues. The NH AES also supported the following basic and applied projects within Goal 2 to create technology and research for the benefit of the state, region and nation. We believe these projects provided excellent results and value from the investment of AES funds and have positioned the NH AES well to successfully achieve the goals of its five year POW plan.

Key Theme - Food Safety

1. Host defenses against Salmonella

a. Brief description of the activity

Food borne disease in humans due to Salmonella continues to be a major health concern. There are two ongoing studies including the determination on how salmonella attach to human cells and to explore approaches that may block that attachment and thus prevent disease. A multi-step affinity chromatography process was developed to obtain a more highly-purified mannan-binding lectin (MBL) product. Various experiments were done and the results indicate that the OmpD porin mediates attachment of Samonella T (ST) to human macrophage-like cells and that this association is modulated by MBL. In the second study, the effect of ST is being examined on the death of human neutrophils through both apoptosis and necrosis using an ELISA protocol to detect cleaved nuclear DNA fragments. Preliminary results show that neutrophils begin to die after about 12 hours and in the absence of bacteria the rates of death due to apoptosis and necrosis are similar.

b. Short Impact/Accomplishment Statement

Salmonella are highly successful pathogens of both animals and humans. Biologically based intervention strategies offer promise for controlling and preventing disease due to this organism. Our studies suggest that naturally occurring substances in the body may be used to enhance host defenses against Salmonella and the products obtained from one species may be effective in others.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $26,888
	State- 71,783
	Total – 98,671
Full-time equivalents:	Sci. 0.3; Prof. 0.3; Total 0.6

d. Scope of Impact: State specific

2. Impact of microcystins on lakes

a. Brief description of the activity

Cyanobacteria toxins, microcystins (MCs), are found worldwide in lakes and are linked to serious health problems. One study of this project is to determine the importance of picoplankton in lakes of different trophy and evaluate the importance of picoplankton in the production and transfer of MCs in the lake food. The results indicated that the relative abundance of picoplankton was negatively correlated with measures of trophic status, such as chlorophyll and total phosphorus. In the upcoming year, lab cultures will be used to establish the specific toxicity of the smaller picoplankton before using new optical bioassay methods to determine the effects of different-sized phytoplankton components.

b. Short Impact/Accomplishment Statement

Potent liver toxins, called microcystins (MCs) are a worldwide problem that is increasing as lakes become more eutrophic. The present study will identify which organisms produce MCs in NH lakes and track their movement into the lake food web. This information will assist in the management of lakes for cyanotoxins and water quality and will also be of use to surface water suppliers of drinking water.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $24,423
	State- 52,767
	Total – 77,190
Full-time equivalents:	Sci. 0.3; Total 0.3

d. Scope of Impact: State Specific

Program Duration

All projects under this goal are for a three to five year period. All projects are targeted for mid and long term problems.

In fiscal year 2005 the New Hampshire Agricultural Experiment Station had 0.6 full time equivalents of scientists time assigned to Goal 2. Their research was funded with federal funds from the Hatch Program. There were 0 full-time equivalents of technical staff attached to these projects. Professional help in the form of graduate students doing research on these projects amounts to 0.3 students. For this goal, there are matching funds from the State of New Hampshire through a line item within the University of New Hampshire's budget. It is not anticipated that any small changes in federal funding in the next five years would significantly alter the spectrum of key program components for Goal 2.

Goal 3: A Healthy, Well-Nourished Population

Issue: The reasons people eat particular foods are complex and the foods that are included in a diet have short-term and long-term health consequences. Knowledge of food-consumption patterns and the results of those choices are needed.

Overview:
The New Hampshire AES has established as output indicators for Goal 3, 1) increased research results from projects dealing with why particular foods that make up a diet are chosen and 2) increased research results detailing the short and long term consequences of food consumption patterns on health issues.

We will evaluate as outcome indicators if our efforts within this goal are contributing to 1) healthier food choices resulting in a better balanced diet for consumers and 2) fewer incidences of disease or disorders directly related to improper diet choices.

We continue a philosophy that the mission of the Agricultural Experiment Station is consistent with Goal 3 and thus provide support to basic and applied sciences that help posture NH to 1) understand and control the metabolism and oxidation in adipose tissue, 2) assess the nutritional risk in the elderly, 3) understand relationships of diseases and gender or age, and 4) assess the functional properties of food protein. Each of these areas contributes to developing and assuring a healthy and well-nourished population. The NH Agricultural Experiment Station supports the following basic and applied projects within Goal 3 to create technology and research for the benefit of the state, region and nation. We believe these projects provided excellent results and value from the investment of AES funds and have positioned the NH AES well to successfully achieve the goals of its five year POW plan.

Key Theme - Human Health

1. Obesity, insulin resistance and asthma in women

a. Brief description of the activity

Atopy is a biochemical precondition for developing allergic asthma. This study is focused on investigating possible mechanisms through which obesity increases the risk of allergic disease, including asthma in adult women. The design of this study was cross-sectional involving fifty-nine asthmatic (n=17) and non-asthmatic (n=42), obese, and non-obese women. Results showed that atopy, characterized by an elevation in circulating specific IgE antibodies, was markedly elevated not only among asthmatic women but also obese, non-asthmatic women in comparison to their respective controls. In addition, both asthmatic and obese, non-asthmatic women, showed impairment in insulin sensitivity, that was indicated by higher fasting levels of either C-peptide or Fasting Insulin Resistance Index (FIRI), relative to their respective controls.

b. Short Impact/Accomplishment Statement

Present findings suggest that increased risk of asthma development, associated with obesity in women, may be related to the effects of metabolic resistance on pulmonary function and a diet high in n-6plyunsaturated fatty acids, particularly arachadonic acid. These findings suggest that lifestyle factors and dietary practices may be important causal agents in the development of asthma and preventable with nutritional and exercise intervention.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $23,952
	State- 73,821

Total – 97,773
Full-time equivalents: Sci. 0.4; Tech 0.5; Total 0.9

d. Scope of Impact: State Specific

2. Control of adipose tissue metabolism

a. Brief description of the activity

Obesity, characterized by excess adipose tissue accumulation, has reached epidemic proportions world-wide. There are two projects that are addressing obesity. The first project had three lines of investigation during the past year. The first study examined the presence and lipolytic impact of the extracellular cyclic AMP-adenosine pathway in adipose tissue using miniature swine. The findings indicated that the extracellular cyclic AMP-adenosine pathway exists in isolated adipocytes and intact adipose tissue. In the second study, initial experiments were done to determine whether the miniature swine could be a suitable model for studying the relationship between obesity and inflammation. The results indicated that this pig model might not be suitable. In the third study, preliminary experiments were done to examine the impact of adipocyte energy status on lipolysis in isolated human adipocytes. Results showed that of the three subjects (two normal, weight, one overweight), only one overweight subject demonstrated a reduced rate of adipocyte lipolysis when cellular energy status was reduced with amonoimidazole-4-caroxamide ribonucleoside. These findings demonstrate that rather than being passive and subject to external control, adipose tissue-from the pig and the human-is a dynamic and metabolically active tissue that possesses inherent and sophisticated metabolic controls. In the second project, the optimal conditions for delivery and expression was determined of the beta galactosidase control as well as the constitutively-active and dominant-negative Notch1adenoviral constructs into the preadipocytic L1 cell line model. The results showed that the combined use of both polyD-lysine and Invitrogen's Optifect transfection reagent allows us to transfect approximately 80% of our target cells/experiment.

b. Short Impact/Accomplishment Statement

Fat cell enlargement is the hallmark feature of obesity. The findings of the first project contribute to our understanding of how fat cells may regulate their own size. The long-term impact of these findings is in contributing knowledge toward reducing the negative health, economic and social outcomes of obesity. In the second project, given that the adipocyte is the primary cell found in adipose tissue, it is exquisitely sensitive to diet induced signals and is ultimately responsible for its fat-storing and endocrine activities. Thus, elucidation of the molecular mechanisms that regulate adipogenesis and adipose tissue function may ultimately increase our understanding of how external factors such as diet and exercise influence the development of severe obesity and the onset of obesity-related disease.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $38,087
State- 65,683
Total – 103,770
Full-time equivalents: Sci. 0.6; Prof. 0.1; Total 0.7

d. Scope of Impact: State Specific

3. Molecular basis of visual function

a. Brief description of the activity

Two projects are examining defects in visual function. Blindness and visual disorders in humans and animals are often caused by biochemical disorders of the retina such as genetic diseases involving faulty opsin genes or errors in opsin gene expression. The first project has completed the enhancements in the extraction and purification of mammalian rod and cone photoreceptor phosphodiesterases (PDE6). Preliminary experiments are ongoing to test the utility of these chromatographic separations of amphibian rod and cone PDE6. Polyclonal antibodies have been generated to immunologically distinguish frog rod and cone PDE6; an anti-peptide antibody to the N-terminal region of frog cone PDE6 showed good discrimination of rod and cone isoforms, while the rod-specific antibody poorly detects either rod or cone DPE6. Efforts are continuing to isolate physiologically competent suspensions of cone photoreceptors free of rod cell contamination. The second project has sequenced the BAC clones containing the cichlid opsin genes and confirmed that cichlid fishes have seven cone opsin genes. Further studies showed that these opsins are differentially expressed through development in tilapia with each gene being turned on at some developmental stage.

b. Short Impact/Accomplishment Statement

Studying how cone photoreceptor cells function at the biochemical level is essential for understanding the initial events in daytime vision and color discrimination. This information is needed to develop effective treatments to slow or reverse diseases of the photoreceptor cells that lead to impairment of visual function or even total blindness. In the second project, it has been shown that trans acting factors are critical to the control of opsin gene expression. Studies are ongoing to identify these factors using a whole genome scan with microsatellite markers.

c. Source of funding/total expenditures/full time equivalents (for 2 projects)

Source of funding: Hatch
Total expenditures: Federal - $36,933
State- 43,656
Total – 80,589
Full-time equivalents: Sci. 0.3; Prof 0.5; Total 0.8

d. Scope of Impact: State Specific

4. Regulation of zinc transport

a. Brief description of the activity

Zinc is an essential nutrient that needs to be present in the proper amounts to support optimal health. The regulation of brain zinc homeostasis was investigated using an in vitro blood-brain barrier (BBB) model composed of porcine brain capillary endothelial cells. Ongoing studies include the investigation of the longitudinal changes in the concentration of the ZnT-1 protein during exposure to a moderately high Zn concentration. The in vitro models of the BBB were exposed to a moderately excessive (50 micoMolar) Zn environment for varying

periods of time (0, 12, 24, 48,72, and 96 H). Protein abundance was measured by Western analysis. AnT-1 protein increased in abundance by approximately 50% within 24 h of Zn exposure, and remained at this elevated level through out the remainder of the measurement period (96 h). This increase I ZnT-1 transport proteins corresponds to changes in zinc transport kinetics and therefore suggest that ZnT-1 serves as one of the mediators of brain zinc homeostasis under conditions of moderate zinc excess.

b. Short Impact/Accomplishment Statement

The result from these studies will advance our knowledge of the molecular mechanisms that enables the brain to maintain zinc balance during periods of zinc excels. This knowledge will help doctors and research scientists interpret their clinical and experimental findings regarding the role of zinc malnutrition in neurological disorders like Alzheimer's disease and other types of dementia.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $20,742
State- 44,961
Total – 65,703
Full-time equivalents: Sci. 0.3; Prof. 0.3; Total 0.6

d. Scope of Impact: State specific

Key theme - Human Nutrition

1. Atherogenesis in normal and diabetic animals

a. Brief description of the activity

Cardiovascular disease is the number one cause of mortality in American men and women. Diabetes accelerates atherosclerosis development. This project examines the effects of hyperglycemia on inflammatory processes of atherosclerosis using hamsters as a model. Hamsters were treated as follows: 1) control, fed a low fat/low cholesterol diet; 2) lipemic fed a high fat/high cholesterol diet; 3) glycemic as induced by streptozotocin (Stz) and 4) lipemic/ glycemic. After 15 weeks of treatment, the aortas were harvested and prepared for histology, immunohistochemistry and Western blot analysis of proteins. Lipemic animals had higher plasma cholesterol; triglycerides were elevated in the lipemic-glycemic group; glucose was elevated in the glycemic and the combined treatment in which insulin and fructosamine were also increased.

b. Short Impact/Accomplishment Statement

Obesity promotes both Type II diabetes and atherosclerosis but the mechanisms by which diabetes advances atherosclerosis are largely unknown. Being able to understand how the hyperglycemia of diabetes affects arterial lesions may lead to better therapies to impede the development of cardiovascular diseases in a growing population of obese diabetic people. The link between hyperglycemia and atherosclerosis appears to be augmented inflammatory processes.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $26,223
State- 74,910
Total – 101,133
Full-time equivalents: Sci. 0.3; Prof. 0.9; Total 1.2

d. Scope of Impact: State Specific

2. Assessing the nutritional risk of the elderly

a. Brief description of the activity

Lutein and zeaxanthin, two carotenoids derived exclusively from the diet, accumulate in the human retina where they are collectively called macular pigment. The objective of this project was to compare the effects of different doses and vehicles of lutein and zeaxanthin on serum concentrations and macular pigment, two biomarkers for dietary intake. Sixty-three volunteers were assigned to one of seven, twelve-week interventions. Macular pigment did not significantly change in groups who consumed placebo, organic eggs, or 9 mg lutein. Macular pigment in the central retina significantly increased from baseline in the 30 g lutein supplement group, the zeaxanthin group and 12 mg of lutein supplement group. Significant increases in macular pigment were observed in after twelve weeks with high doses of lutein or zeaxanthin from either supplement or food.

b. Short Impact/Accomplishment Statement.

The results of this project may directly benefit individuals at risk for age-related macular degeneration. AMD is the third leading cause of blindness globally, and has been directly linked to retinal concentrations of lutein and zeaxanthin. The findings of this project suggest that individuals may decrease their risk of developing AMD by increasing their consumption of lutein and zeaxanthin. The findings of this project may also benefit researchers investigating biomarkers for dietary lutein and zeaxanthin.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $29,324
State- 57,109
Total – 86,433
Full-time equivalents: Sci. 0.3; Total 0.3

d. Scope of Impact: Multistate Research (CT-Storrs, DC, ME, MD, MA, MN, NH, PA, Purina Mills, RI, USDA/ARS)

3. Assessing food intake of the elderly

a. Brief description of the activity

Ongoing work is focusing on the establishment of stations, research questions and identification of food choice factors associated with fruit, vegetables and whole grains using cognitive interviewing techniques with older adults. A literature review revealed few studies about food choice factors and shopping practices for whole grain foods for this target

audience while more is known about fruit and vegetable purchasing practices of older adults. Therefore, research questions will focus on older adults cognitive processes related primarily to whole grain foods. Cognitive interviewing techniques will be utilized during a semi-structured interview with a convenience sample of older adults to determine how whole grain foods are identified using the information on product packages as well as factors and barriers related to the purchase of whole grain foods. Draft research questions and protocol continue to be developed by a core planning group of four stations via conference calls and email.

b. Short Impact/Accomplishment Statement.
Identification of food choice processes used by older adults to purchase whole grain foods will enable nutrition educators to design effective interventions for this target audience.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $585
	State-
	Total – 585
Full-time equivalents:	Total: 0.0

d. Scope of Impact: Multistate Research (CT-Storrs, DC, ME, MD, MA, MN, NH, PA, Purina Mills, RI, USDA/ARS)

Key Theme - Food Quality

1. Protein Structure During High-pressure Cycling

a. Brief description of the activity
High pressure is used as a method of sterilization and preservation of food substances. While scientists understand the effects of static high pressure on molecular structure, the causes of the reported effects of the pressure cycling are not known. The purpose of this project was to design, construct and test modifications to a pressure-cycling apparatus that will permit optical evaluation of molecules throughout pressurization and depressurization cycles. The barocyler device proved to be of limited value in examining protein structure due to its pressure limits. Although, a new barocyler has been obtained and there are now ongoing experiments of how sterilization by pressure cycling may be made more efficient. This project also looked at the charge effects of protein nonideality using other means. The results of this project indicate that the nonideality of trace quantities of protein of known valence can be determined in concentrated, complex solutions.

b. Short Impact/Accomplishment Statement
Pressure cycling may offer a superior method for sterilizing fluids and for inactivating the enzymes responsible for food spoilage. Our work focuses on maximizing the efficiency of sterilization by pressure cycling. These developments will improve the safety of the food stream, help increase the shelf-life of foods and reduce its cost.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $29,252
State- 48,353
Total – 77,605
Full-time equivalents: Sci. 0.3; Prof 0. 7; Total 1.0

d. Scope of Impact: State specific

Program Duration
The research projects that contribute to this goal are generally of three to five years duration. All projects are targeted for mid and long term problems.

In fiscal year 2005 the New Hampshire Agricultural Experiment Station had 2.5 full time equivalents of scientist's time assigned to Goal 3. Their research was funded with federal funds from the Hatch and Multi-State Research Programs. There were 0.5 full-time equivalents of technical and clerical staff attached to these projects. Professional help in the form of graduate students doing research on these projects amounts to 2.6 students. For this goal, there are matching funds from the State of New Hampshire through a line item within the University of New Hampshire's budget. It is not anticipated that any small changes in federal funding in the next five year's would significantly alter the spectrum of key program components for Goal 3.

Goal 4: An Agricultural system that Protects Natural Resources and the Environment

Issue:
Agriculture is a human activity and as such goes on within a larger environment. Agriculture and forestry activity can have major impacts on soil and water and land ecology and its environment because of their direct links to soil, water, air, and biological resources.

Overview:
The New Hampshire AES has established as output indicators for Goal 4, research activity that deals with the problems associated with agricultural and forestry practices as related to the environment. We will evaluate the outcome indicator of whether our efforts within this goal are contributing to an agricultural and forestry industry that is productive yet minimizes environmental impact. We continue a philosophy that the mission of the Agricultural Experiment Station is consistent with Goal 4 and thus provide support to basic and applied sciences that help posture NH to maintain a sustainable environment and forest industry.

The NH Agricultural Experiment Station supports the following basic and applied projects within Goal 4 to create technology and research for the benefit of the state, region and nation. We believe these projects provided excellent results and value from the investment of AES funds and have positioned the NH AES well to successfully achieve the goals of its five year POW plan. Each of the following projects contributes to maintaining a sustainable environment.

Key Theme - Biodiversity

1. Genetic diversity of northeastern conifer species

a. Brief description of the activity

Deforestation, air pollution and climate change impact the distribution and population structure of conifers species in forests. Work is continuing to differentiate mitochondrial haplotypes within each species. Additional mitochondrial loci have been amplified using a new set of mitochondrial primers designed from Norway spruce. Of seven primer pairs tested, four pairs supported amplification of red and black spruce DNAs. To determine whether any of these loci would be useful population differentiation, amplified templates were sequences from individuals of each species, representing different geographic provinces. So far the locus m27 is most promising for red spruce; four SNPs were uncovered in the first 500 bp including a 5 bp indel. Once the preliminary sequencing reactions have been completed, SNP assays will be designed to determine the distribution of these polymorphisms and corresponding pattern of haplotypes across the current range of red spruce.

b. Short Impact/Accomplishment Statement

As a result of periodic glaciations of the Northern Hemisphere, the geographic distribution of red and black spruce have changed dramatically. Understanding the changing population structure of these forest species will help us predict how their distributions may change as a result of global warming.

c. Source of funding/total expenditures/full time equivalents

Source of funding: McIntire-Stennis
Total expenditures: Federal - $24,477
State- 34,623
Total – 59,100
Full-time equivalents: Sci. 0.3; Prof 0.1; Total 0.4

d. Scope of Impact: State Specific

2. Forest management and plant biodiversity

a. Brief description of the activity

The biodiversity of forested ecological reserves is dynamic and may decline due to natural succession and as adjacent areas become developed. Ongoing research shows that stems of the invasive shrub glossy buckthorn can be aged using annual wood rings. This suggests that the number of rings in stems closely approximates plant age, at least in our populations of buckthorn. Preliminary data from one site suggested that ring count was related to stem diameter. Thus, it may be possible to estimate stem age by measuring stem diameter—a method that is much faster than counting rings.

b. Short Impact/Accomplishment Statement

Glossy buckthorn, an invasive shrub known to inhibit tree seedling establishment, invades transition hardwood-white pine forests in southern New Hampshire after clear-cutting and populations continue to grow even after canopy closure. Thus, these invasive shrubs represent a threat to forest productivity in this region.

c. Source of funding/total expenditures/full time equivalents

Source of funding: McIntire-Stennis
Total expenditures: Federal - $34,117
State- 60,794
Total – 94,911
Full-time equivalents: Sci. 0.3; Prof 0.9; Total 0.6

d. Scope of Impact: State specific

3. Floristic diversity in old growth forests

a. Brief description of the activity

This project is focusing on the composition of the insular flora of secondary forest on islands in Lake Winnipesaukee. Plant specimen identifications were completed and vegetation plot data were analyzed. The flora of Timer Island consists of 190 vascular plant species, known of which were listed as rare or endangered; 24 species of bryophytes were also recorded. Abundance and frequency data from 106 plots were analyzed by using a two-way indicator species analysis program (TWINSPAN). The result was the identification of six vegetation cover types. Two indices of similarity were used to compare the island flora with floras known from 3 other island floras in Lake Winnipesaukee.

b. Short Impact/Accomplishment Statement

This project is important to a more comprehensive understanding of botanical diversity in forests of New Hampshire and the northeast, and helps establish important baseline data in comparing managed and unmanaged forests. A better understanding of our forests is important in protecting ecologically significant sites.

c. Source of funding/total expenditures/full time equivalents

Source of funding: McIntire-Stennis
Total expenditures: Federal - $22,072
State- 28,140
Total – 50,212
Full-time equivalents: Sci. 0.2; Prof. 0.2; Total 0.4

d. Scope of Impact: State specific

4. Predicting range expansion in the Gulf of Maine for introduced species

a. Brief description of the activity

Seaweed biodiversity assessments are useful in evaluating both short and long-term changes. A comparison of long-term floristic changes (early 1900s versus present-day) within Casco Bay, Maine, which is the state's 2nd largest embayment, has shown varying patterns of reduced % similarity and species richness within different habitats depending upon anthropogenic impacts. Several introduced red algae and a green alga was also documented, particularly within the Fore River/Portland Harbor area where there is extensive shipping and previous shellfish aquaculture. In addition, two major rapid assessment surveys of non-native and native marine species of floating dock communities have been conducted within the Northeast Coast of USA. In the first study, seven introduced seaweeds were documented,

including the green alga and six red algae. In the second study, only a few introduced species were found.

b. Short Impact/Accomplishment Statement
The significances of these studies are several fold: 1) the pattern and mechanisms of introductions of invasive species are being delineated, hopefully aiding with their management and control; 2) the proposed Sea Grant studies will attempt to clarify if multiple and genetically diverse populations are colonizing the Gulf of Maine; 3) the systematic and molecular studies are helping to clarify patterns of species diversity and possible introductions.

c. Source of funding/total expenditures/full time equivalents
Source of funding: Hatch
Total expenditures: Federal - $24,258
State- 60,421
Total – 84,679
Full-time equivalents: Sci. 0.3; Total 0.3

d. Scope of impact: State Specific

5. Biodiversity of aquatic plants
a. Brief description of the activity
Biodiversity in New England versus tropics is considerably underestimated. Field studies in the temperate latitudes were completed on the botanical diversity of two large peat lands within the Lake Umbagog National Wildlife Refuge developed as a consequence of raised water levels in the lake after construction of the Errol, NH, dam in 1853. The botanical inventories document a vascular flora of 178 species recorded in the 2 peat lands, 111 of which occur in both peat lands; the Leonard Marsh flora consists of 50 families, 96 genera, and 142 species, while 50 families, 96 genera, and 148 species compose of the flora of Harpers Meadow. A detailed analysis of the vegetation using a TWINSPAN classification of 617 quadrates sampled resulted in the delineation of nine cover types (CT). A tenth cover type consisting of aquatic vegetation, the Brasenia schreiberi-Potamogeton spp. CT, was recognized based on qualitative field observations. Despite the recent formation of these peat land complexes following the construction of the Errol Dam, the vegetation composition of Leonard Marsh and Harpers Meadow shares broad similarities with peat lands in New England the north-central United States.

b. Short Impact/Accomplishment Statement
The biodiversity studies continue to indicate that aquatic/wetland plant diversity appears to be richer in temperate regions of northeastern North America than in the neotropics. A better understanding of the biodiversity in our wetlands is needed to aid in conservation and management decisions.

c. Source of funding/total expenditures/full time equivalent
Source of funding: Hatch
Total expenditures: Federal - $14,336

State- 32,315
Total – 46,651
Full-time equivalents: Sci 0.2; Prof. 0.2; Total 0.4

d. Scope of Impact: State specific

Key Theme - Biological Control

1. Endocrine control of reproduction in fish
   a. Brief description of the activity
   Three studies were completed in the past year on the control of gonadotropin-releasing hormone (GnRH) in reproduction. In the first study, type II lamprey GnRH receptor was identified via cDNA cloning, BLAST analysis and in situ hybridization. In the second study, the GnRH receptor was examined by a series of efficacy and kinetic studies and shown to be functional as well as lamprey GnRH-III selective. In the third study, functional and pharmacological characterizations of the lamprey GnRH receptor were done using a series of C-terminal tail truncations. Activation of the lamprey GnRH receptor was shown to stimulate cAMP production in a dose dependant manner when treated with either lamprey GnRH-I or lamprey GnRH-III, which was shown to require the presence of the C-terminal tail.

   b. Short Impact/Accomplishment Statement
   This unique lamprey GnRH receptor, with both high affinity for lamprey GnRH-III and chicken GnRH-II and ligand binding activity in the tail-less form represents an important ancestral state which provides insight into the function and evolution of the vertebrate GnRH receptor family. Gaining a further understanding of gonadotropin-releasing hormone, its analogs, its receptors, interactions with neurotransmitters and microencapsulation will be critical for development of novel strategies for improving and controlling reproduction.

   c. Source of funding/total expenditures/full time equivalents
   Source of funding: Hatch
   Total expenditures: Federal - $24,075
   State- 98,528
   Total – 122,603
   Full-time equivalents: Sci. 0.3; Prof. 1.2; Total 1.5

   d. Scope of Impact: State Specific

2. Hormonal control of beetle reproduction and rearing characteristics
   a. Brief description of the activity
   The overall of this research is to establish the role of juvenile hormone (JH) in reproductive physiology and behavior of burying beetles, which serve as a model species for insects, which rely on an opportunistic breeding resource. The first study was to determine the JH profiles during reproductive maturation and during a breeding bout. JH hemolymph titers were measured every 3 to 4 days during the three weeks of maturation and at six points during a reproductive bout for one of the four burying beetle species and for the carrion beetle. The JH profile of the carrion beetle is low through a breeding bout, as is the most

basal group of the burying beetles. In a second study, the costs and benefits for the carrion beetle of the male behavioral strategy in guarding females. Male carrion beetles defend females, not the breeding resource like burying beetles. They face a very different social environment where they are very little overt aggression.

b. Short Impact/Accomplishment Statement
This study suggests that juvenile hormone has a role in regulating social behavior, i.e. aggression. It may still have an impact on regulating reproductive physiology in conjunction with neuromodulators. This extends the understanding of the actions of this important insect hormone.

c. Source of funding/total expenditures/full time equivalents
Source of funding: Hatch
Total expenditures: Federal - $17,036
State- 44,500
Total – 61,536
Full-time equivalents: Sci 0.3; Prof 0.6; Total 0.9

d. Scope of Impact: State specific

3. Microbial mechanisms for bioremediation
a. Brief description of the activity
This project set out to understand the mechanisms of how bacteria degrade petroleum pollutants, with the ultimate goal to enhance future bioremediation efforts. Two different approaches were taken. The first was to examine at the cellular level using electron microscopy how the bacteria incorporate oily pollutants like alkanes within the hydrophilic interior of the cell. Using sterology to quantify inclusion body volume in hundreds of electron micrographs, we established that hexadecane uptake was immediate and that maximum inclusion body formation occurred in early exponential phase. In addition, alkane degradation was examined in both Acinetobacter and several other bacteria using various alkane substrates. Each culture demonstrated a specific range of chain length alkanes on which they grew, and growth rates were found to vary greatly depending on the substrate and whether the substrate was provided as a liquid or vapor phase. In the second approach a method an attempt was made to use flow cytometry in combination with fluorescent in situ hybridization to count different bacterial members in a contaminated site. The results from these studies indicate that flow cytometry may have limited application for bacterial counts on contaminated groundwater samples.

b. Short Impact/Accomplishment Statement
The long-term impact of this research is to improve bioremediation strategies. Petroleum products are the most common pollutants in the environment, and the use of bacteria to degrade these toxic chemicals can be enhanced when we have a clear understanding of the microbial mechanisms involved in this process.

c. Source of funding/total expenditures/full time equivalents
Source of funding: Hatch

Total expenditures: Federal - $1,889
State- 12,639
Total – 14,528
Full-time equivalents: Sci 0.1; Prof 0.3; Total 0.4

4. Impact and Control of Trematode Parasites

a. Brief description of the activity

Trematode parasites influence commercially and ecologically important marine species and human health. This project addresses what factors most strongly influence trematode species diversity and overall prevalence within marine nearshore communities and determines at what spatial scale they operate. A spatially explicit database of the diversity and abundance of trematode parasites infecting the host snail, Littorina littorea, has been compiled from more than 40 sites along the New England coast. Environmental parameters, physical measurements and biological measurements were recorded at each site. In addition, the rates of infection have been quantified by the most dominant marine trematode parasite in marine shorebirds in New England. Ongoing work is quantifying physical degradation in NE marshes trough GIS techniques.

b. Short Impact/Accomplishment Statement

The diversity and abundance of parasites within the snail Ilyanassa obsolete have been quantified. Determination of the drivers of parasitic infection may ultimately be a powerful means to understand the determinants of trematode population dynamics across spatial scales, thus helping to predict and address trematode impacts on commercially and ecologically important nearshore marine species. Secondly, because impacts to nearshore environments may affect species in different ways, the power of using trophically-transmitted parasites as indicator species is that they potentially integrate the effects of nearshore impacts across many species from different trophic levels with different physiologies and life history strategies.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $17,673
State- 44,839
Total – 62,512
Full-time equivalents: Sci 0.3; Prof 0.4; Total 0.7

5. Molecular Markers and Control of Two Flatworm Pests

a. Brief description of the activity

Marine flatworms commonly prey on mussels and oysters and can have great impact on bivalve aquaculture. The main goals of this project are to isolate DNA markers that can be used to track these flatworms. Genomic DNA was extracted from samples of Notoplana and of Stylochus and the gene coding for cytochrome oxidase I (CO-I) has been amplified using universal primers. Sequencing of the amplified samples resulted in an intraspecific difference of 0.2% for Stylochus and 0.5% for Notoplana. New primer design is in progress, as is the evaluation of additional genes (28S rDNA, ITS). Furthermore, using sagittally sectioned animals, it has been determined that Notoplana atomata should be placed more appropriately

in Pleioplana atomata, thus following the classification system of Faubel (1983).

b. Short Impact/Accomplishment Statement
The two flatworm species preferentially feed on bivalve mollusks, including those important in the aquaculture industry. Their impact on spat survival can be considerable and in some areas has been shown to exceed 90%. The identification of a molecular marker to understand their population genetics is imperative for their control.

c. Source of funding/total expenditures/full time equivalents
Source of funding: Hatch
Total expenditures: Federal - $16,325
State- 43,541
Total – 59,866
Full-time equivalents: Sci 0.3; Prof 0.2; Total 0.5

Key Theme - Forest Resource Management

1. Controls on Forest Soil Solution Chemistry
a. Brief description of the activity
Forest soil solution chemistry is an indicator of overall ecosystem function and a driver of stream water quality in forested watersheds. The effects of organic matter and nutrient supply on the solution chemistry of forest soils were determined by sampling soil solution from lysimeters at three long-term experimental manipulations. Results pooled across all the sites and experiments show that production of dissolved organic carbon (DOC) is remarkably insensitive to N additions and the changes in ecosystem structure (primary productivity, soil microflora) that accompany N fertilization. Nor is DOC production strongly related to organic matter supply; only litter doubling significantly affects DOC concentrations. Dissolved organic nitrogen (DON), in contrast, is very sensitive to inorganic N application, with concentrations doubling or tripling with fertilization. These results suggest a fundamental decoupling of the C and N cycles with changes in nitrogen inputs.

b. Short Impact/Accomplishment Statement
This project provides fundamental information about controls on soil solution chemistry in forest ecosystems, with an emphasis on factors controlling the production and delivery of dissolved organic carbon and nitrogen to surface waters. Dissolved organic carbon and dissolved organic nitrogen are important in aquatic nutrient cycles and as contaminants in drinking water supplies. Better understanding of forest nutrient cycles will improve forest management and facilitate predictions of changes in forests with changing climate.

c. Source of funding/total expenditures/full time equivalents
Source of funding: McIntire-Stennis
Total expenditures: Federal - $27,811
State- 20,908
Total – 48,719
Full-time equivalents: Sci. 0.2; Prof. 0.3; Tech. 0.1; Total 0.6

d. Scope of Impact: State Specific

2. Role of fungi in forest floor nutrient availability

a. Brief description of the activity

Removal of coarse woody debris from the forest may adversely affect soil nutrient availability. This project determines if the decay fungi found in decaying coarse woody debris are linked to and transport minerals from mineral soil. Collections of 1) decaying wood placed in backfilled soil pits, 2) decaying wood in previously felled logs next to these pits, 3) basidocarp fruiting bodies, and 4) soil from all organic and mineral layers were retrieved at various intervals from sites in the White Mountain National Forest in Bartlett, New Hampshire. Samples were returned to the laboratory for selective isolation of basidiomycetes. Morphological characteristics, somatic compatibility, reactions to chemicals, and DNA analyses were used to identify suspected basidiomycetes from the various substrates. The wood decay fungus Hypholoma sublateritium was determined to link the mineral (BC & E) and organic (Oe) soil layers to decomposing coarse woody debris. This link supports the possibility that energy stored in wood debris can facilitate the vertical transfer of elements and compounds with the soil profile. Isolates of H. sublateritium were identified in all substrates by sequencing their nuclear ribosomal DNA (nrDNA) in the ITS1-5.8S-ITS2 region using the primers ITS1-4.

b. Short Impact/Accomplishment Statement

The detection of a hyphal bridge of Hypholoma sublateritium from mineral soil to decaying woody debris suggests that decay fungi may play a major role in biogeochemical cycling within forests for replenishing elements in organic soils by transporting these elements from mineral soils as part of the decay process. The detection of H. sublateritium as forming a hyphal bridge between mineral soil and decaying wood should prompt the search for other species exhibiting this phenomenon and may lead to a reevaluation of forest management practices.

c. Source of funding/total expenditures/full time equivalents

Source of funding:McIntire-Stennis
Total expenditures: Federal - $18,807
State- 41,279
Total – 60,086
Full-time equivalents: Sci. 0.3; Total 0.3

d. Scope of Impact: State Specific

3. Measuring stocking and structure in N. H. forests

a. Brief description of the activity

Improved description of forest stocking and structure is needed to meet increasing social demands for market and non-market benefits of managed forests. The following work has been completed on this project: 1) improved understanding of the relationship between leaf area, common stocking measures, and production in New Hampshire forests; 2) improved inventory of structural legacies, including snags and downed logs, in New Hampshire forests; 3) better understanding of appropriate sampling techniques, including boundary overlap

correction and double-sampling approaches; and 4) maintenance of a long-term growth and yield plot network, in support of the above objectives.

b. Short Impact/Accomplishment Statement
This project developed new tools for assessing forest stocking and structure. These tools will lead to improved management of New Hampshire forests for both timber and non-timber objectives.

c. Source of funding/total expenditures/full time equivalents
Source of funding: McIntire-Stennis
Total expenditures: Federal - $30,563
State- 31,868
Total – 62,431
Full-time equivalents: Sci. 0.3, Prof. 0.1, Total 0.4

d. Scope of Impact: State specific

4. Remotely sensed forest vegetation mapping
a. Brief description of the activity
Previous work has demonstrated the limitations of using moderate spatial resolution satellite imagery to map and monitor complex New England forest cover types. Additional work has shown that pixel based analysis on higher spatial resolution imagery while significantly better is still far below the needed accuracy levels. As a result, this project seeks to evaluate polygon-based approaches to using higher spatial resolution imagery for mapping forest vegetation in Pawtuckaway State Park, NH. The analysis to date of this work has relied on an extensive GIS database of the forest vegetation at Pawtuckaway State Park. Collection of these data and reference data will be essential for further analysis of the map projects to be generated in this project.

b. Short Impact/Accomplishment Statement
Spatial data analyses (remote sensing and GIS) are valuable tools for mapping and monitoring our natural resources and the environment. This technology is changing rapidly and new advances are occurring everyday. The continued development of techniques for improving our abilities to make accurate maps is essential to our continued wise use of our natural resources.

c. Source of funding/total expenditures/full time equivalents
Source of funding: McIntire-Stennis
Total expenditures: Federal - $41,745
State- 55,340
Total – 97,085
Full-time equivalents: Sci. 0.3, Prof. 1.0, Total 1.3

d. Scope of Impact: State specific

5. Genetic control of stress response of trees

a. Brief description of the activity

The goal of this research is to genetically manipulate the metabolism of polyamines (putrescine, spermidine and spermine) in poplar cells in order to test if this alteration causes a positive physiological responses of the cells to osmotic, salinity and aluminum stress. Data to data show that manipulation of a single step in the polyamine (PA) metabolic pathway has far-reaching consequences. The expression of a mouse ornithine decaroxylase transgene in poplar cells has provided evidence of the co-regulation of expression of several genes in the PA biosynthetic pathway.

b. Short Impact/Accomplishment Statement

An examination of the transcript levels and enzyme activities of the key regulatory enzymes as well as the metabolites revealed a complex homeostatic mechanism at work involving several parts of the pathway operating in a coordinated manner. The results of research will lead to a better understanding of the regulation of metabolic pathways in plant that will allow the use of transgenic approach to manipulate plant metabolism. In the long run, this will help us produce trees that have the desirable qualities of wood, fiber and other useful products, as well as being tolerant of various types of abiotic stress.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	McIntire-Stennis
Total expenditures:	Federal - $30,006
	State- 36,232
	Total – 66,238
Full-time equivalents:	Sci. 0.1; Prof 0.2; Total 0.3

d. Scope of Impact: State Specific

6. National atmospheric deposition program

a. Brief description of the activity

During this past year, soils were collected from chronic (low and high) nitrogen additions to forest soils at the Chronic Nitrogen Addition Study at Harvest Forest. The samples were analyzed for total and active bacterial and fungal biomass, microbial catabolic response profiles, the activities of cellulolytic and ligninolytic enzymes, and total, labile and microbial-derived organic C. Active fungal biomass was 27-61% and 42-69% lower in the fertilized compared to control plots in the hardwood and pine stands, respectively. Active bacterial biomass was not significantly affected by N additions, resulting in significantly lower fungal:bacterial biomass ratios in the N treated plots. A Data Set for publication in Teaching Issues and Experiments in Ecology was also developed (TIEE) and is a peer-reviewed web-based collection of ecological educational materials.

b. Short Impact/Accomplishment Statement

Forest productivity is dependent on nutrient cycling processes that are mediated by soil microorganisms. Microbial activity in turn is controlled to a large degree by temperature, moisture, and nutrient availability. Our work showed that nitrogen deposition and soil warming, two environmental changes of significance to the New England region, alter microbial community structure and function.

c. Source of funding/total expenditures/full time equivalents
Source of funding: Hatch
Total expenditures: Federal - $26,700
State- 41,181
Total-67,881
Full-time equivalents: Sci 0.3; Prof. 0.5; Total 0.8

d. Scope of Impact: State Specific

7. Effects of Invasive shrubs in forest management activities

a. Brief description of the activity

During this past year, the invasibility of 44 early-successional sites in southeastern New Hampshire were examined using a two-tiered approach. Colonization (Tier 1) and establish and spread (Tier 2) o invasive shrubs at patches early-successional habitat were compared to landscape and local habitat features. Landscape elements were associated with colonization whereas spread of invasive shrubs at a patch of early-successional habitat was described exclusively by local features. Prevalence of agricultural fields was the most influential feature affecting both colonization and spread of exotic shrubs. Results of this study provided an initial approach for identifying early-successional habitats that may be especially prone to alien shrub invasions. Another study investigated how invasive shrubs may affect the abundance and variety of insects and some of their predators (small mammals and snakes) in among six sites of early-successional forests. Abundance and taxa richness of insects affiliated with foliage and leaf litter were not correlated with native shrub coverage. Abundance and variety of small mammals and snakes did not vary with the proportion of native shrub coverage. Future investigations will examine responses by strict insectivores to more completely assess food chain effects of invasive plants.

b. Short Impact/Accomplishment Statement

Results from this investigation will likely have a substantial influence on sustainable forest management activities. Such information will be especially important to land owners that seek green certification for their management activities because limiting exotic plants is a major criterion of such certification programs.

c. Source of funding/total expenditures/full time equivalents
Source of funding: McIntire -Stennis
Total expenditures: Federal - $34,867
State- 36,789
Total- 71,656
Full-time equivalents: Sci 0.3; Prof. 0.2; Total 0.5

d. Scope of Impact: State Specific

Key Theme - Water Quality

1. Insect-based water quality statements

a. Brief description of the activity

The insect faunas of seventeen central New Hampshire rivers/streams have now been surveyed from May to October. The presence and abundance data of the insect species has been completed, and has been incorporated into a paper treating species richness/abundance patters for 26 rives in southern and central New Hampshire. Similarity and cluster analyses revealed that the central and southern faunas of New Hampshire are significantly different, and that sampling of these faunas has been critical for composition of keys treating the entire New England fauna. These data have been used to construct illustrated keys to nine major groups of insects as a hard-copy, and these keys have been distributed as pdf files to individuals in state departments, contracting businesses, and teachers interested in checking the keys, and in contributing specimens that will increase the regional coverage of the keys.

b. Short Impact/Accomplishment Statement

The major groups of stream insects of southern New Hampshire have been identified, and keys for identification prepared. The identification keys and their associated information on seasonality, distribution, abundance, and reactions to stream enrichment will allow a more definitive statement by those groups involved in monitoring water quality. The keys will be well-illustrative and will allow a wider participation by groups interested in being directly involved with monitoring water quality and to a much more precise level by species-level precision.

c. Source of funding: Hatch
Total expenditures: Federal - $37,438
State- 98,329
Total – 135,767
Full-time equivalents: Sci. 0.8; Total 0.8

d. Scope of Impact: State specific

2. Pathogen persistence in Class B limed sludge (2 projects)

a. Brief description of the activity

Land application of biosolids may pose a public health risk due to the presence of pathogenic microorganisms. Two projects evaluate the effectiveness of several conventional biosolids treatment processes on the fate of pathogens (adenovirus, astrovirus and Cryptosporidium). In the first project, the inactivation of adenovirus, astrovirus and bacteriophage were examined in alkaline stabilized class B biosolids intended for land application. Bench to models of alkaline stabilization procedures were developed and virus was spiked into biosolids, mixed for 2 hours at pH 12 and then for 22 additional hours at pH 11.5. This was done at two different temperatures, room temperature and 4 degree Celsium. Samples were periodically collected over time, processed for virus and then assayed for the presence of infectious virus. Results indicate that enteric viruses were inactivated relatively quickly, within the first two hours along with the simultaneous inactivation of phage. Inactivation was slightly retarded at the colder temperature, but virus was still undetectable after two hours at pH of 12 using class B biosolids with a 4% total solids. In the second project, three liters of fresh raw sewage influent was collected and filtered to recover an environmental strain of C. perfringens on mCP agar. Isolated colonies on mCP agar were confirmed as C. perfringens

using reverse cAMP, BAP and API strips. The experiments did confirm that C. perfringens is ubiquitously present in sewage influents. Further experiments were done the results of these experiments revealed that C. perfringens spores are an indicator of the reduction in microbe viability in a benchscale anaerobic digestor system at this temperature.

b. Short Impact/Accomplishment Statement
Results from project one have demonstrated that virus is inactivated during the alkaline stabilization process using class B biosolids at 4% total solids. It is hoped that this work will help eliminate fears that infectious virus in land applied biosolids presents a public health risk both by direct exposure and through the contamination of underground aquifers. In the second project it was shown that the use of cell culture to assess the infectivity of Cryptosporidium parvum oocysts is a cost effective and more rapid method to determine whether oocysts have been inactivated by treatment methods in comparison to the gold standard of animal infectivity.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $19,758
	State- 46,125
	Total – 65,883
Full-time equivalents:	Sci 0.5; Prof 0.4; Total 0,9

d. Scope of Impact: Project 1 – Integrated Research and Extension; State specific
Project 2 – State specific

3. Application of sewage biosolids to agricultural soils (2 projects)
a. Brief description of the activity
Land application of biosolids has proven to be a controversial agricultural practice. Biosolids are valuable as soil amendments, but their land application can affect numerous systems. Two projects examine the effects of long-term application of biosolids on water quality, pathogen persistence and soil microbial biodiversity. In the first project, chemical analysis of groundwater at a former gravel pit showed an unexpectedly large increase in nitrate concentrations (above drinking water criteria) in some wells in the treatment area, but little to no increase in others. Areas with high nitrate appeared to be associated with past stockpiling of sewage sludge on the site. Analysis of metals in soils of the stockpile areas is underway to attempt to quantify the impact of stockpiling on soil biogeochemistry. Despite the high nitrate levels, no wells have shown any significant increases in trace metal concentrations. The second project brought together individuals from the Northeast and parts of Canada to look at the effects of the Application of Sewage Biosolids to Agricultural Soils in the Northeast.

b. Short Impact/Accomplishment
The results from one project showed that regulations and permit conditions were not sufficiently protective of groundwater quality at sites where repeated applications of biosolids are made. Changes in NH state regulations were made as a result of this study. In

the second project there were two outcomes. The first was a report that was developed based on the work done by the individuals as well as an accessible database for other individuals to access via the web. In addition, a webpage was developed to go along with the report. In the second outcome, several samples were evaluated for the presence of human enteric pathogens on a farm that was fertilized with manure and possible biosolid contamination. In one instance, virus was found. This group is continuing to examine the impact of biosolid applications to land.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $23,834
State- 45,595
Total – 69,429
Full-time equivalents: Sci 0.4; Tech. 0.2; Total 0.6

d. Scope of impact:

1. State specific
2. Multistate; Integrated Research and Extension (DE, MA, NJ, PA, NYC, NH)

Key Theme - Wildlife Science and Management

1. Predation effects on food stream webs

a. Brief description of the activity

The results of the first two years of work examining responses of wood frogs and spotted salamanders at 49 vernal pools to changes in wetland isolation and surrounding landscape characteristics suggested that spotted salamanders may be more sensitive to increasing wetland isolation than wood frogs. Egg mass counts of wood frogs were highest at more isolated wetlands and were not dependent on wood frog occupation of adjacent vernal pools whereas egg mass counts of spotted salamanders were higher when adjacent wetlands had breeding populations. Additional experiments were done and preliminary analysis on spotted salamander egg mass counts indicated that the number of egg masses at focal wetlands was not correlated with the total number of egg masses at neighboring sites; however, the total number of egg masses counted was correlated with the total number of sites indicating that local landscapes with higher densities of vernal pools should support higher populations.

b. Short Impact/Accomplishment Statement

Successful conservation and management of vernal-pool dependent species requires an understanding of both upland and wetlands requirements. Few empirical studies have been conducted to examine patterns of wetland use by vernal pool-dependant species across both the wetland isolation and upland habitat availability gradients. The results of this study provide valuable guidelines for prioritizing vernal pool protection for vernal pool dependent species and will refine best management practices adjacent to vernal pools.

c. Source of funding/total expenditures/full time equivalents

Source of funding: McIntire-Stennis
Total expenditures: Federal - $35,500

State- 48,202
Total – 83,702
Full-time equivalents: Sci. 0.3; Prof 0.5; Total 0.8

d. Scope of Impact: State specific

Key Theme - Other

1. Developing genetic systems for Frankia

a. Brief description of the activity

The purpose of this study is to develop new tools for the genetic manipulation of Frankia. The physical properties of the Frankia genome are being investigated and a physical map of the Frankia chromosome was developed by use of macrorestriction analysis and pulse-field-gel-electrophoresis. The genome sizes of three Frankia strains were determined. Preliminary investigations involved the development of site-specific mutagenesis protocols. From these investigations, truncated hemoglobin genes were identified by PCR. Using varying environmental conditions, it was shown that the hemoglobin expression was not affected when Frankia was grown in media with or without a combined nitrogen sources. Ongoing work is examining the role of the hemoglobin genes in symbiosis.

b. Short Impact/Accomplishment Statement

This study has led to the development of essential genetic and genomic tools for this bacterial system. These protocols will aid in efforts to use actinorhizal plants to provide renewable resources for fuel and restore previously disrupted environments. An understanding of the Frankia genome will help further bioremediation and phytoremediation applications with this system, especially on heavy-metal-contaminated-land.

c. Source of funding/total expenditures/full time equivalents

Source of funding: Hatch
Total expenditures: Federal - $20,472
State- 68,071
Total – 88,543
Full-time equivalents: Sci. 0.3, Prof. 0.7, Total 1.0

d. Scope of Impact: State Specific

2. Food Security and Open Space Conservation

a. Brief description of the activity

This work is focusing on producing a sequel to the volume “The Wisdom of Small Farms and Local Food: Aldo Leopold’s Land Ethic and Sustainable Agriculture.” Ongoing research is being conducted as to which soils are best suited for grazing productivity in the region and where these soils are located in the four states. An identification of the maximum geographical area of grazing potential is the goal. Preliminary new soils maps have been developed. Study is also being conducted on integrated systems, to maximizing nature’s capital, and to the services that such integrated systems can provide in support of efficiency maximization at the lowest level of nonrenewable energy input possible.

b. Short Impact/Accomplishment Statement
Expected impact includes continuation of my senior level and graduate course in applied agrarian values, and the planning of a new undergraduate inquiry course in the same field, using UNH's university farms, organic campus community garden, the organic livestock herd, and local farmers markets and CSA's as a base.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $22,424
	State- 51,407
	Total – 73,831
Full-time equivalents:	Sci. 0.3; Total 0.3

Program Duration

The research projects that contribute to Goal 4 are generally of three to five years duration. All projects are targeted for mid and long term problems.

In fiscal year 2005 the New Hampshire Agricultural Experiment Station had 7.0 full time equivalents of scientist's time assigned to Goal 4. Their research was funded with federal funds from the Hatch, McIntire-Stennis, and Multi-State Research Programs. There were 0.1 full-time equivalents of technical staff attached to these projects. Professional help in the form of graduate students doing research on these projects amounted to 8.2 students. For this goal, there are matching funds from the State of New Hampshire through a line item within the University of New Hampshire's budget. It is not anticipated that any small changes in federal funding in the next five years would significantly alter the spectrum of key program components for Goal 4.

Goal 5: Enhanced Economic Opportunity and Quality of Life for Americans
Issue:

Research is necessary to help people improve their economic status in order to improve their perceived quality of life.

Overview:
The New Hampshire AES has established as an output indicator for Goal 5, increased applied and basic research to define the issues that improve quality of life, at what expense, and to improve the chances that rural communities can provide these opportunities.

We will evaluate the outcome indicators of 1) more rural communities capable of providing employment opportunities to their residents, and 2) rural communities better able to adjust and adapt to structural changes in agriculture and forestry so that they remain viable and exciting places in which families may reside. We continue a philosophy that the mission of the Agricultural Experiment Station is consistent with Goal 5 and thus provide support to basic and applied sciences that help posture to maintain enhanced economic opportunity and quality of life for Americans. The NH Agricultural Experiment Station supports the following basic and

applied projects within Goal 5 to create technology and research for the benefit of the state, region and nation. We believe these projects provided excellent results and value from the investment of AES funds and have positioned the NH AES well to successfully achieve the goals of its five year POW plan. Each of the following projects contributes to maintaining economic opportunity and quality of life.

Key Theme - Community Development

1. Improvement of rural and agricultural sample survey methods (#427, Robertson)

a. Brief description of the activity

To be effective, local state and federal agencies and non-profit organizations need to be able to identify, characterize, and communicate with all stakeholder groups of a specific program or policy. Studies were designed and implemented to assess two distinct stakeholders groups (e.g. commercial fishermen and research scientists) attitudes and behaviors associated with their involvement in cooperative research. In addition, this project designed, developed, implemented and evaluated methods for characterizing and communicating with stakeholders of distinct resource management programs/policies (i.e., Statewide Comprehensive Outdoor Recreation Planning Communities Response to Change, and a Cooperative Research Program). Findings suggest that the two stakeholders share common motivations (i.e., to improve the quality of science, professional growth, and financial benefits) and experienced a similar challenge (i.e., securing the application of the results from their cooperative research project in fishery management and policy). The initiative designed has been adapted and used by NH Fish and Game Department and the UNH Cooperative Extension Service. The Web-based Tool has been successfully used to expand the number of people participating in resource management and policy development process.

b. Short Impact/Accomplishment Statement

The National Park Service Land and Water Conservation Fund Administrator indicated that they would be recommending the State Comprehensive Outdoor Recreation Plan coordinators adopt the web-based public involvement tool designed, implemented and evaluated by this project. The plan expanded the number of people participating in the process from 40 to 400 and improved both the quality and quantity of information considered in the development of the plan. Relative to the evaluation of the Northeast Consortium Cooperative Research Program, this project enhanced the quality and quality of the data collected through a multi-method research design of stakeholders.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $17,282
	State- 40,203
	Total – 57,485
Full-time equivalents:	Sci. 0.3; Prof. 0.2; Total 0.5

d. Scope of Impact: State Specific

2. Rural economic development alternatives in the northeast (3 projects)

a. Brief description of the activity

The future of rural America depends on decisions made by citizens, businesses, and legislators. The first project is designed to understand the effects of public policy and rural industries. Cross-sectional data on town-level land use and conservation/current use land was used to determine how industrial, commercial, agricultural, and open-space preservation uses affect municipal expenditures to provide a detailed analysis of the net costs of development, including the no development option, on New Hampshire communities. Work underway includes estimating seemingly unrelated regressions and a systems analysis will incorporate interrelated relationships often omitted or underestimated in many past studies. A parallel analysis has estimated the economic impacts of a major activity that contributes to sustaining open space lands. In the second project, two surveys were completed to investigate the market for locally made goods and services in New Hampshire. The third project is examining the health care problem in rural New Hampshire and evaluating alternative policies that could improve the situation.

b. Short Impact/Accomplishment Statement

In the first project, better defining the economic base of a given region using the reported multipliers will make a greater understanding of the unique character of each of these regions. Knowledge of these multipliers should help recreation managers, town planners, and politicians to better target investment in open space and tourism in order to develop these industries in a more sustainable and compatible manner with a local community. The expected impacts of from the second project include a better understanding of the importance of support programs to local businesses. Do significant state promotion programs affect consumer loyalty for local businesses? The Executive Director of NH Made has used information from both studies to leverage state and foundation funds that support and promote local businesses within the state of New Hampshire. The survey of NH Made members has been used to improve support services, such as Ecommerce training in rural areas. The third project provides information on the economic importance of a hospital in a rural area.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $38,565
	State- 80,628
	Total – 119,193
Full-time equivalents:	Sci 0.5; Prof 0.5; Total 1.0

d. Scope of Impact: Multistate; Integrated Research and Extension (AR, CO, DE, GA, ID, IA, IN, KY, ME, MI, MN, MO, NV, NH, NY-Ithaca, NC, ND, OH, OR, PA, RI, SC, USDA/ERS, UT, VA Tech, WA, WI)

3. Economic considerations in municipal solid waste disposal

a. Brief description of the activity

Solid Waste Management in the U.S. has become a major problem for local government, especially in rural areas. Specific issues relate to cost considerations, environmental quality,

facility sites, and economic efficiency. A survey of all New Hampshire towns was conducted and data were analyzed to determine the extent, impact, and future directions for privatization of provision of municipal services. Private contractors, including waste management, are now providing many services traditionally provided by local government. While previous surveys in this field have indicated that there are a large number of services which could potentially be privatized, examination of survey responses showed that solid waste disposal, recycling, street sweeping, park maintenance, janitorial services, building maintenance, tax assessing, and title record maintenance were the services which were commonly privatized among New Hampshire towns. Results from three logit models indicate that small towns may have a harder time getting competitive bids; private contracts are not improving service quality in New Hampshire; low fiscal stress can be associated with existing contracts but the model is inconclusive as to whether high fiscal stress leads to future contracting.

b. Short Impact/Accomplishment Statement
Local governments, especially those in rural areas, are facing ever-increasing stress on their limited revenues. This is especially true in New Hampshire where the major source of revenue is the property tax. Town governments have looked to the possibility of privatizing provision of some municipal services as a way to increase efficiency and reduce costs. The current study and its extensions will provide valuable information to these decision makers in terms of what services work best when privatized, what factors influence privatization and satisfaction with privatization, and which towns have had the most success with privatization.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $16,608
	State- 58,768
	Total – 75,376
Full-time equivalents:	Sci. 0.3; Prof 0.4; Total 0.7

d. Scope of Impact: State specific

4. Benefits and costs of resource policies (2 projects)
a. Brief description of the activity
The first project is surveying three NH towns for three issues: 1) looks at towns that have had ballot measures to preserve open space; 2) consumer surveys to gauge willingness to pay for products that come from agriculture or forestry; and 3) asks small business owners to assess their business. Ongoing work includes a series of focus groups and a survey of local residents regarding the Cape Wind proposal. This proposal outlines plans to build wind turbines in Nantucket sound. Data analysis is ongoing. To date, there is a greater than 55% response rate. The second project focuses on the influence of community gardening on community empowerment. Ongoing work involves assessing socio-cultural, physical and economic factors on community gardens.

b. Short Impact/Accomplishment Statement
The expected impact on the first project is an unbiased report to the Federal Agency

conducting the Environmental Impact Analysis. This report is an integral part of the Environmental Impact Analysis required to approve or decline the Cape Wind proposal. In the second project, the impacts relate to the spatial patterns of community gardens on Boston's landscape, the reasons why it is practiced in different geographic sectors, and where additional public support for community gardening, as a viable urban land-use, might be target.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal - $33,984
	State- 70,093
	Total – 104,077
Full-time equivalents:	Sci. 0.5; Total 0.5

d. Scope of Impact: Multistate; Integrated Research and Extension (AL, CA-Administration, CA-Berkeley, CA-Davis, CT-Storrs, CO, GA, IA, KY, LA,ME, MD, MA, MI, NH, NY-Ithaca, ND, OH, PA, OR, RI, TX, UT, WA, WV, WY)

6. Welfare reform and the well-being of rural low-income families

a. Brief description of the activity

This project has tracked over time the individual and family circumstances, functioning and well being of rural low-income families with children in the context of welfare reform. This project worked on three objectives 1) to assess across time the relative effects of economic opportunity and personal attributes and actions, on employment and self-sufficiency among the rural low income families participating in this study and 2) to collect additional data in year 3 of this study to track the functioning of the participating families related to changing policies and economic conditions and 3) to assess the well being of participating NH rural families with regard to health, food security, employment, and receipt of public assistance. The project website (hppt://www.ruralfamilies.umn.edu) has facilitated data sharing for the multi-state project researchers. Central data processing has facilitated the merging of the multi-state data that has revolved around three themes: food security, economic well being, and health.

b. Short Impact/Accomplishment Statement

A website devoted to the NH project and outcomes is under construction and should be available in 2005. Connections have been made with all of the local coalitions and AARP who are reaching the EITC eligible populations through free tax preparation sites. The NH Statement EITC Alliance has been formed to share best practices amongst the community coalitions and share resources. Outreach has increased through print, non-print media and a collaboration has been formed with an information and referral agency to be the starting point for information.

c. Source of funding/total expenditures/full time equivalents

Source of funding:	Hatch
Total expenditures:	Federal $6,712
	Total 6,712

Full-time equivalents: Total 0.0

d. Scope of Impact: Multistate; Integrated Research and Extension (CA-Davis, CA-Riverside, IN, IA, KY, LA, MD, MA, MI, MN, NH, NJ, NY-Ithaca, OH, OR, SD)

Program Duration

The research projects that contribute to this goal are generally of three to five years duration. All projects are targeted for mid and long term problems.

In fiscal year 2003 the New Hampshire Agricultural Experiment Station had 1.6 full time equivalents of scientist's time assigned to Goal 5. Their research was funded with federal funds from the Hatch, McIntire-Stennis, and Multi-State Research Programs. There were 0 full-time equivalents of technical staff attached to these projects. Professional help in the form of graduate students doing research on these projects amounted to 1.1 students. For this goal, there were matching funds from the State of New Hampshire through a line item within the University of New Hampshire's budget. It is not anticipated that any small changes in federal funding in the next five years would significantly alter the spectrum of key program components for Goal 5.

B. Stakeholder Input

The N. H. Agricultural Experiment Station has developed an Advisory Committee, **representing a diverse group of stakeholders**. The group meets once or twice per year to exchange ideas for increasing this station's effectiveness in serving stakeholders and the citizens of our state. The station welcomes stakeholder input through this committee as well as individually. The Advisory Committee is comprised of the following members:

David Babson
N. H. State Representative

Nancy Berliner
N. H. Rural Development Council

Deanna Howard
Dartmouth-Hitchcock Medical Center

Jeff Huntington
Pleasant View Gardens

Barry Kelley
Forest industry

Tom Kelly
UNH Sustainability Program

Peter Lamb
New Hampshire Charitable Foundation

Jeanie McIntyre
Upper Valley Land Trust

John McLean
UNH Farm Manager

Dean Moreau
Yankee Farm Credit

Anne Sprague
Edgewater Farm

Chris Streeter
Blue Seal Feeds
N. H. CARET representative

Edith Tucker
The Coos County Democrat

Sharon Francis
Connecticut River Joint Commission

Hal Bodwell
Dairy Producer

Nancy Franz
UNH Cooperative Extension

1. COLSA is developing an on-line yearly newsletter targeted largely to stakeholders have been produced and each sent to an audience of approximately 10,000 per issue. Yearly issues of "INSIGHTS" address events, people and contributions from the College of Life Sciences and Agriculture (COLSA) and the NH AES. A separate issue of "Research Highlights" emphasize the contributions and impacts of research sponsored by the NH AES and COLSA. Constituent reaction to these NH AES publications is encouraged.

2. The Research Advisory Committee continued to assist the Agricultural Experiment Station administration in AES proposal reviews and to recommend research areas of State and regional importance for particular AES focus.

3. The NH AES Director served on the NH Current Use Board, attended community fact-finding meetings and served on the State Conservation committee to obtain stakeholder input.

4. The NH AES has been a participant in several State Fairs as well as the NH Farm and Forest Exposition. These activities facilitate direct stakeholder input.

5. The NH AES Director attended meetings with the Farm Bureau, representatives of the NH Horticulture Association the NH Equine Committee, and the Farm and Forest Expo Leadership.

6. Representatives of the NH AES have visited NH farms, orchards, greenhouses and extension twilight meetings to speak directly with constituents.

7. Representatives of the NH AES have been very active in the initiation and planning of the first Organic Dairy Research farm at a land grant institution through outreach to the community including farmers, veterinarians, nutritionists, researchers, educators, students and others throughout the northeast who are interested in organic, sustainable, and low input farming practices.

Statement of the process used to identify stakeholders and collect input.
We will continue to meet once or twice per year with the NH-AES Advisory Committee to exchange ideas for making this station most effective in serving stakeholders and the citizens of our state. We expect that other, regular means of communication will be implemented as this new initiative progresses.

In addition to the interaction with our Advisory Committee, the NH AES sends its INSIGHT and Research Highlights publications to citizens of the state and region requesting input on research areas, concerns and needs. The NH AES and the College of Agriculture representatives

accompany a prepared display to state and regional fairs and expositions to meet stakeholders, distribute information and obtain input. The NH AES Administrators also meet stakeholders and acquire input by presenting talks at meetings of various grower groups, the Grange and Farm Bureau. The AES Administrators and others working with the NH AES visit state and regional farms, orchards, greenhouses, and extension meetings to assess needs and collect input. The AES Administrators frequently travel to different counties with Extension Specialists to obtain input on integrated needs.

Statement of how collected information was considered.
Information from a variety of stakeholder sources has been incorporated into AES policy. Concerns over AES-funded projects that might better serve the needs of the state and region led to a change in the criteria for evaluating AES program proposals. An explanation of how the project will impact state and/or regional needs is now required. Concerns over limited support for horticulture, the fastest growing area of the NH agricultural economy, and concerns for water quality have led to AES project funding targeted in those two areas. In addition to our expanded efforts to identify and engage stakeholders, the NH-AES has begun efforts to have a survey instrument developed to assess the needs of a larger population of stakeholders. The AES is sponsoring (with preparation through the UNH Department of Resource Economics) the creation of a survey instrument and the survey of New Hampshire citizens to obtain input on the needs and results of AES projects as defined by the five national goals. Additionally, the Advisory Committee assists the AES to identify important current and emerging needs, and to advise the AES on matters such as preferred mechanisms for timely delivery of research findings to end users. Through the AES, a Steering Committee for the Organic Dairy Farm has been established to provide oversight and provide a review of financial, operational and management plans for the Organic Dairy Farm.

C. Program Review Process

The New Hampshire Agricultural Experiment Station has had a peer review process for projects for over fifteen years. The proposal process applies to all Goals and is as follows. Each August a letter is sent to all faculty in the College of Life Sciences and Agriculture and to Deans of other Colleges announcing a competition for Hatch and McIntire-Stennis funds. Faculty must submit a one page description of their proposed project and subsequently meet with the AES Associate Director to discuss the work. If the proposed project is determined to fit within the guidelines for support from either of these two funds, the faculty member develops a full proposal using the CSREES/USDA format. Faculty must also suggest five potential external (non-UNH) peer reviewers from whom the Associate Director obtains at least two anonymous reviews. After the reviews are returned, the faculty member then has the opportunity to revise the proposal or rebut the reviewer's comments, if they wish. The next step in the process is the project funding priority evaluation performed by an internal committee of five faculty members who are experienced in research. All proposals are reviewed, taking into account the external reviewer's evaluations and the faculty member's response. From this, the committee recommends a priority for submission to USDA for approval. The AES Administrators use this recommendation and their own 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 approval for funding. We will continue this process in New Hampshire. However, we have modified it to utilize the results of stakeholders input. When the call for proposals is sent out

each year, it now includes guidelines of the criteria used for internal proposal evaluation. These criteria include, 1) research quality and potential, 2) how the proposal addresses state, regional and stakeholder issues, 3) the quality of the prior year progress report, and 4) outcomes (including publications and grant submissions) from the work performed.

D. Evaluation of the Success of Multi and Joint Activities

1. Did the planned programs address the critical issues of strategic importance.
The NH AES is involved with multi-state and joint activities focusing on topic areas that are included in our POW. Each area and project addresses a critical issue of strategic importance as described by its placement within the list of the five national goals above. These activities include:

- Improved supply of nutrients to dairy cows
- Predicting bovine fertility
- Improving nutrition for dairy calves
- Control of plant growth systems (also extension)
- Genetics and breeding of Cucurbita (not listed as multistate)
- Strawberry production in modified environments
- Conservation of plant genetic resources
- National Animal Genome Research Program
- Assessing the nutritional risk of the elderly
- Impact sewage biosolid application to agricultural soils
- Rural economic development alternatives in the northeast
- Benefits and costs in natural resource planning
- Welfare reform and the well-being of rural low-income families
- Sustainable local food systems

Many of these projects originated as the result of stakeholder input and continue to address stakeholder needs.

2. Did the planned programs address the needs of under-served and under-represented populations?
While not all of the multistate and joint projects were designed to serve the under-represented and under-served populations, most of the projects in the multistate list above do, in fact, directly serve under-represented and under-served populations. These include the poor, the homeless, small communities with less than adequate resources and representation, families in rural areas, the elderly, the undernourished, those seeking self-sufficiency, and farmers seeking new crops or replacement crops for species with declining sales, among others.

3. Did the planned programs describe the expected outcomes and impacts?

Individual projects are at different stages of maturity and have exhibited different levels of impact. Each multistate and joint project, in our opinion, has been a sound investment of federal and state funds, thereby continuing research progress and benefiting the citizens of the state and region. Examples of the outcomes and impacts derived from these projects are indicated below.

Examples below indicate some of the outcomes and impacts derived from these projects.

- The Ruminant Feed Analysis Consortium resulted from two Hatch and multistate projects. The consortium represents a collaborative effort among researchers, feed testing laboratories, and the commercial feed industry to analyze ruminant feed, quantify relationships between the chemical composition of feeds and nutritive value, and stimulate feed analysis development and standardization.

- Improving reproductive efficiency is an economic concern to the cattle industry. Research to understand late embryonic/early fetal mortality in cattle and to determine effects of environmental/metabolic stressors will assist the design of improvement strategies.

- Poultry health will be improved by greater understanding of the genes that affect avian immunity. Improved health represents a substantial economic benefit to poultry breeders and producers.

- Breeding of squash, gourds, and tomatoes has improved productivity, decreased harvest injury, and enhanced produce quality. Investigations of harvest time and eating quality in acorn squash conducted in 2003, 2004, and 2005 demonstrated that premature harvest of squash reduces quality substantially in most cultivars.

- NE 1012 continued to demonstrate clear, practical solutions for strengthening local food systems economically and nutritionally.

- Genetic and genomic tools have been developed to enable more effective identification, preservation and utilization of wild strawberry germplasm. This will enable the development of improved cultivated varieties.

- Genomic resources developed to identify the genetic basis for several commercially important traits in tilapia, including sex, skin color and salinity tolerance have immediate applications for breeding improved strains of tilapia.

- Modifiable factors such at dietary carotenoids and weight appear to decrease risk of aging-related eye disease. These findings have significant public health implications to prevent eye diseases.

- Changes in NH state regulations resulted from NH AES research on land application of sludge biosolids. Previous regulations and permit conditions were not sufficient to protect groundwater quality at sites undergoing repeated biosolid applications.

- Opinions and motivating factors for buying New Hampshire made products and services were identified from out-of-state visitors. The work was in conjunction with the 'New Hampshire's Own: A Product of Yankee Pride' marketing campaign.

- State and national leaders can use the results of research on rural communities to design

strategies for strengthening their economies. Investments should be targeted in health-care, tourism, and e-commerce.

4. Did the planned programs result in improved effectiveness and/or efficiency?

Multi-state research has allowed NH to leverage its results beyond the value of the funds expended. We have increased communication and coordination among states but decreased duplication of efforts. Multistate research expenditures have the best project return for dollars invested across the NH portfolio of AES-sponsored research. Further efficiency has been realized through efforts to improve our integrated research. Communication between the NH AES and NH-Extension had become poor because the two entities did not have same University reporting lines. Efforts to improve integrated research have enhanced communication and provided the opportunity for effective collaboration.

E. Multistate Extension Activities

This section is not applicable to the NH-AES

F. Integrated Research and Extension Activities

From the table of integrated projects below, one may see that the NH AES spent at least $410,599 of a combined Federal allocation for Hatch and Multistate of at least $1,363,744. This represents a 30.1% integrated portfolio, in excess of the 20% agreed to in FY 2000. Pertinent information is included in the table below. A brief description of the progress to date on each planned activity follows the table.

Integrated Projects

Name	Project Number	Project description	FY 2005	
Loy J. Brent	H-462	Conservation and utilization of plant genetic resources	Federal $	16,307
Kocher Thomas	H-474	National Animal Genome Research Program	Federal $	17,137
Taylor Robert	H-459	Genetic bases for resistance and immunity To avian diseases	Federal $	35,977
Fisher Paul	H-463	Developing and integrating components for commercial greenhouse production system	Federal $	10,302
Curran-Celentano Joanne	H-475	Improving Plant Food (Fruit, Vegetable and Whole Grain) Availability and Intake in Older Adults	Federal $	29,324
Violette, Catherine	H-477	Improving Plant Food (Fruit, Vegetable and Whole Grain) Availability and Intake in Older Adults	Federal $	585
Margolin Aaron	H-414	Application of sewage biosolids to agricultural soils in the Northeast: Long-term impacts and beneficial uses	Federal $	10,484
McDowell William	H-415	Application of sewage biosolids to agricultural soils in the Northeast: Long-term impacts and beneficial uses	Federal $	13,350
Giraud Kelly	H-442	Rural communities, rural labor markets and public policy	Federal $	16,631
	H-443	Benefits and costs of natural resources policies affecting public and private lands	Federal $	11,599
Schwab Charles	H-447	Metabolic relationships in supply of nutrients for lactating cows	Federal $	35,282
	H-448	Management systems to improve the economic and environmental sustainability of dairy enterprises	Federal $	32,518

Townson Dave	H-444	Ovarian and environmental influences on embryonic/	Federal $	22,942
		fetal mortality in ruminants		
Tsang Paul	H-445	Ovarian and environmental influence on embryonic/	Federal $	27,637
		fetal mortality in ruminants		
Lindsay Bruce	H-446	Benefits and costs of natural resources policies affecting	Federal $	22,385
		public and private lands		
Morris Douglas	H-449	Rural communities, rural labor markets and public policy	Federal $	29,934
Erickson Peter	H-450	Management systems to improve the economic	Federal $	22,122
		and environmental sustainability of dairy enterprises		
Dolan, Elizabeth	H-460	Rural low-income families: tracking their well-being and	Federal $	6,712
		Function in an era of welfare reform		
Kelly, Tom	H-473	Sustaining Local Food Systems in a Globalizing	Federal $	9,362
		Environment: Forces, Responses, Impacts		
Trumble, William	H-111	Director, NH-AES	Federal $	24,490
Assessments			**$**	**15,519**
TOTAL			**$**	**410,599**

Integrated Project Descriptions

Loy J. Brent H-462 Conservation and utilization of plant genetic resources

This breeding program has developed new kabocha squash varieties that are gradually replacing buttercup squash in supermarkets and has developed a new Orange Blossom tomato variety which is the first orange class early slicing tomato that has eating quality equivalent to red varieties.

Kocher, Thomas H-474 National Animal Genome Research Program

This program is using genomic resources for tilapia to identify the genetic basis for several commercially important traits in tilapia, including sex, skin color and salinity tolerance. These discoveries have immediate applications for breeding improved strains of tilapia for commercial aquaculture. The development of genetic and physical maps is expected to lead to complete sequencing of the tilapia genome as a model fish species.

Tayloy, Robert H-459 Genetic bases for resistance and immunity to avian diseases

This program identified a microsatellite marker as a useful tool to identify chicken major histocompatibility complex (MHC) haplotype in chickens. Poultry health will be improved by greater understanding of the genes that affect avian immunity. Improved health represents a substantial economic benefit to poultry breeders and producers.

Fisher, Paul H-463 Developing and integrating components for commercial greenhouse production system

This program has developed decision-support tools for flowering potted plants based on plant growth and development models that has resulted in workshops, an internet case study, a training website called FloraSoil, a collaborative book called “Lighting Up

Profits" and development of a training guide using powerpoint slides. Twenty-one universities are using these systems to train new growers in an integrated, scientific approach to crop management.

Curran-Celentano, Joanne H-475, H-477 Improving Plant Food Availability and Intake in Older Violette, Catherine Adults

The results of this project in identifying carotenoids in the diet may directly benefit individuals at risk for age-related macular degeneration. The findings to date of this project suggest that individuals may decrease their risk of developing age-related macular degeneration by increasing their consumption of carotenoids. Identification of food choice processes used by older adults to purchase old grain foods will enable nutrition educators to design effective interventions for this target audience.

Margolin, Aaron H-414 Application of sewage biosolids to agricultural soils in the Northeast: Long-term impacts and beneficial uses

Land application of biosolids remains a very contentious topic. However, land fills are quickly running out of room and ocean disposal or incineration are not viable options, hence, other alternatives that move us as a society towards sustainability need to be explored. To help diminish the apprehension often encountered in the land application process, further research is being done on the survival and migration of pathogens once they have been applied to the land.

McDowell, William H-415 Application of sewage biosolids to agricultural soils in the Northeast: Long-term impacts and beneficial uses

Application of sludge as biosolids to the land remains a practice enveloped in controversy. The results from one project showed that regulations and permit conditions were not sufficiently protective of groundwater quality at sites where repeated applications of biosolids are made. Changes in NH state regulations were made as a result of this study.

Giraud, Kelly H-442 Rural communities, rural labor markets and public policy

Comparison of consumer internet buying preferences with producer internet selling patterns is shared with the business owners through the 'New Hampshire's Own' program so that they can better know their potential in the e-commerce market. The consumer and producer surveys will be repeated in subsequent years to see if e-commerce shopping and selling patterns change over time in New Hampshire.

Giraud, Kelly H-443 Beneftis and costs of natural resources policies affecting public and private lands

This study was conducted before the launch of the 'New Hampshire's Own: A Product of Yankee Pride' marketing campaign. The study will be repeated in the following years to

estimate the impact of that campaign on New Hampshire businesses, especially agricultural businesses.

Schwab, Charles — H-447 Metabolic relationships in supply of nutrients for lactating cows

Improving the efficiency of conversion of feed protein to milk protein is fundamental to both environmental and economic sustainability of the US dairy industry. This study has focused on ruminally-protected amino acids to enhance protein utilization, to increase milk protein and to decrease nitrogen excretion. More precise feeding for protein increases the conversion of feed nitrogen to meat and milk protein. This reduces the potential for nitrogen pollution and decreases feed costs.

Schwab, Charles — H-448 Management systems to improve the economic and environmental sustainability of dairy enterprises

The research will allow for more precise protein and amino acid formulation of dairy cattle diets. The result will be increased conversion of feed nitrogen to animal protein. This will not only reduce losses of excreted nitrogen, which is of growing environmental concern, but it will also increase dairy herd profitability.

Townson, Dave — H-444 Ovarian and environmental influences on embryonic-fetal mortality in ruminants

This project has examined the relationship of uterine involution to resumption of ovarian function following parturition. While uterine fluid collections in postpartum cows do not appear to affect ovarian function per se, conception rate is diminished in cows with large fluid collections. Further study of uterine involution in the postpartum cow with regard to conception is warranted, and offers tremendous potential for improving fertility in multiparous cows.

Tsang, Paul — H-445 Ovarian and environmental influence on embryonic/fetal mortality in ruminants

Elucidating the mechanisms by which heat stress affects ovarian function may provide insight toward understanding the lower fertility rates associated with high environmental temperatures during the summer in the northeastern United States. This may lessen the economic loss to dairy producers. Also, determining how structural modifications alter ovarian function may provide insight toward understanding their effects on reproductive cyclicity and fertility.

Lindsey, Bruce — H-446 Benefits and Costs of Natural Resources Policies Affecting Public and Private Lands

The spatial patterns that community gardens manifest themselves on Boston's urban landscape are influences by certain soci0-cultural, physical and economic factors. The

impacts will determine why certain geographic sectors are used and where additional public support for community gardening may be targeted.

Morris, Douglas H-449 Rural communities, rural labor markets and public policy

This program showed that the fishermen strongly favored cooperative research, but sometimes feel inconvenienced by conflicting schedules or bad weather, which occasionally results in opportunity costs. Better defining the economic base of a given region using the reported multipliers will make a greater understanding of the unique character of each of these regions. Knowledge of these multipliers should help target investment in tourism in order to develop this industry in a more sustainable and compatible manner with a local community.

Erickson, Peter H-450 Management systems to improve the economic and environmental sustainability of dairy enterprises

Lactoferrin may increase intestinal development resulting in more efficient nutrient use and healthier calves. Up to now, lactoferrin has only been evaluated in conventional milk replacer feeding regimens. This study will determine its efficacy in high protein milk replacer feeding programs and whether lactoferrin enhances intestinal development. Chlortetracycline is not beneficial in improving heifer reproductive performance.

Dolan, Elizabeth H-460 Rural Low-Income Families: Tracking their Well-Being and Function in an Era of Welfare Reform

A website is under construction for NH which will have a profile of NH participants in assessing the relative effects of economic opportunity, and personal attributes and actions on employment and self-sufficiency among the rural low income families participating the study.

Kelly, Tom H-473 Sustaining Local Food Systems in a Globalizing Environment: Forces, Responses, Impacts

NE 1012 continued to demonstrate clear, practical solutions for strengthening local food systems economically and nutritionally. In addition, it is predicted that NE 1012 will play a key role in building a long-term research capability in the region to support dairy farmers.