Annual Report of Accomplishments and Results
FY2004

University of Vermont Extension and Vermont Agricultural Experiment Station

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Submitted by:
Douglas O. Lantagne, Interim Director
University of Vermont Extension _____
Doug.Lantagne@uvm.edu
802-656-2990

Michael Vayda, Director
Vermont Agricultural Experiment Station
And Associate Dean
College of Agriculture and Life Sciences _____
Michael.Vayda@uvm.edu
802-656-0555

Executive Summary

The Vermont Agricultural Experiment Station (VT-AES) was established in 1886 as a state and federal partnership to serve the agricultural needs of the state through research. In fiscal year 2004, there were 174 new and ongoing research projects conducted at the Station funded by both public and private sources. These projects covered a broad range of critical areas including agricultural products and other agriculture-related economic opportunities; water quality; health and nutrition; and plant and animal gene function. VT-AES researchers are nationally and internationally recognized for their excellence.

University of Vermont (UVM) Extension was established in 1912 as a state and federal partnership to provide Vermonters timely research-based education and information. Programs were offered throughout the state with a special focus on increasing agriculture business profitability, supporting forest and farm stewardship, promoting economic development, teaching nutrition and food safety as well as providing youth programs. Extension made more than 100,000 Vermont contacts in fiscal year 2004. Information and education was provided through more than 350 educational Extension programs including at least three contact hours each, collaborative community programs, the *Across the Fence* daily television program, as well as smaller-scale workshops and individual consultations.

During FY 2004 more than 1,000 farmers improved business and management operations, thereby reducing costs and increasing net profits. Many of these changes also reduced the negative effects of their operations on air and water quality, created products for new niche markets, and increased the long-term sustainability of their operations through diversification. Twenty-five more produce processing operations comply with standards at or exceeding HACCP standards of food safety. Fifty more farmers are in compliance with state and federal water quality protection regulations as a result of assistance and use of UVM-developed phosphorous indices and skill-development in applying CropMD software developed with Pennsylvania State University.

Research is directly helping farmers to improve operations, create new niches for their products, and market to new audiences. Several organic new soy-based products including low moisture tofu, fortified soy milk, and tempeh have been developed and tasted-tested by panelists. Symbiotic soy yogurt and beverage have also been developed. Results of survey research completed in FY 2004 has provided outreach specialists with key information about Vermont consumer practices regarding organic foods, genetically modified foods, fair-trade-produced foods, foods produced and processed meeting Good Agricultural Practices (GAP) standards, and agri-tourism. Dairy herd management and farm profitability is being enhanced through VT-AES research breakthroughs that have identified genetic, physiological, and environmental influences on short and long term milk yields.

This past year, 5,000 more consumers improved their food handling and food safety skills. More than 1,000 Vermont adults and youth, most living in families with limited incomes, have improved their knowledge and skills about eating more nutritional meals, have increased their experience eating healthier meals, and have applied important tools to losing weight, maintaining weight loss through physical activity, and/ or shopping for and growing healthy foods that reduce monthly food security concerns and improve health. Additionally, 60 seniors have gained important computing and internet skills, and have improved healthy eating habits through innovative on-line curricula and links. Internet resources have been shown, through Hatch funded research, to be effective tools in reducing weight loss for overweight adults. Web resources, developed and tested by UVM, have

assisted 400 Vermonters gain access to public food support dollars.

UVM research that has led to the development of whey-based de-icers and wood finishing products will reduce farm waste and improve agriculturally affected water quality indices. Our nationally recognized integrated pest management program, leading research into biomimicry and other biologically based strategies to reduce pest impacts on gardens and crops is reducing farmer and gardener reliance on manufactured pesticides, and their introduction into local air and water supplies. Outreach programs have lead to a 20% rise in soil testing that can improve gardening and farm productivity, while reducing use of fertilizers, and runoff of excess nutrients into waterways. Thirty more schools in the state include curriculum on water quality for middle school students, and 600 more students use this information to present information to their town officials and other public servants, potentially influencing local and regional water quality policies. Thirty more owners of recreational lands have created or expanded sustainable resource-based businesses for their property.

More than two thousand Vermont youth reported improvement in life skills development as a result of their participation in 4-H clubs, camps, curricula, competitions, and other activities. One UVM-developed, community-based middle-school curriculum has been tremendously successful during its three-year pilot at a rural school concerned about high drop-out rates, at reducing student drop-out rates, improving parent, teacher, student, and administrative relationships, increasing academic success for at-risk students. More than three thousand newly separating or divorcing parents have improved parenting and coping skills for helping children through this period of change. Communities have benefited from more than $13,000,000 leveraged to support local economic and sustainability enterprises benefiting rural residents, leading to more than 100 new jobs and nationally recognized tourist destinations infusing capital into local economies.

The work of UVM Extension and the VT-AES is made possible through the support of a state and federal partnership. State support augments Extension's outreach and VT-AES research efforts by matching federal funds from the United States Department of Agriculture (USDA). Funds assist faculty in seeking other competitive funds and partnerships. In fiscal year 2004, 71% of UVM Extension expenditures were supported by the State and 29% were supported by Smith-Lever funding. In addition, Extension faculty, staff, and volunteers were engaged in more than $1 million in other federal and competitive grants and contracts. In fiscal year 2004, 30% of the Vermont Agricultural Experiment Station expenditures were supported by the State and 18% were supported by federal Hatch funds. The remaining VT-AES expenditures were supported by competitive grants and contracts secured by researchers; faculty associated with VT-AES secured grants and contracts accounting for more than $4 million, or 52% of the expenditures.

Due to a decade of level federal funding, there were insufficient funds to cover increased salary and operating expenses. This necessitated a reduction in operating expenses and faculty (four Extension faculty and two VT-AES faculty) in order to develop a sustainable budget. Additionally, UVM Extension enacted efforts that include establishing an annual fund-raising campaign, improving program marketing, initiating cost recovery and cost accounting systems, and determining specific program focus. To maintain and expand critical applied research and outreach programs, both VT-AES and UVM Extension will continue to rely upon entrepreneurial faculty to secure grant funds to enhance programs and research.

A. FY 2004 Highlights of UVM Extension and Vermont Agricultural Experiment Station

NATIONAL GOAL AREA 1: AN AGRICULTURAL SYSTEM THAT IS HIGHLY COMPETITIVE IN THE GLOBAL ECONOMY.

UVM Extension and VT-AES expended 23.71 FTE's, or 33% of total effort, toward National Goal Area 1, spending $3,037,168 in federal and state funds toward projects in this area. VT-AES initiated or continued more than 30 research projects, and UVM Extension made 48,686 contacts during this time, including contacts with 2,998 youth. UVM Extension worked with 480 volunteers contributing 6,435 hours of their time toward programming in this National Goal Area. Effort is valued at $64,350 based on $10 per hour.

DAIRY

VT-AES researchers:

- made breakthroughs in understanding environmental and physiological influences on bovine mammary development;
- learned of ways to reduce bovine mastitis through work that identified infection-responsive genes, representing a major step to understanding mechanisms that contribute to mastitis disease resistance;
- measured the effects of transforming growth factors on mammary development and potential for milk production that gives dairy producers insight into the mechanisms involved in mammary growth and development; and
- quantified the effects of hormonal induction, photoperiod and milking treatments and physiological stage on indices of mammary gland development and function.

Researchers developed a forage quality prediction model for the first harvest of cool season grasses and alfalfa to improve dairy production and profits, and determined the most cost-effective irrigation and nutrient application protocols to improve pasture yields. Outreach efforts used this and other information to create a unique pasture outreach program combining workshops and conferences with discussion groups, farm-based networks, and pasture walks that has doubled membership in four years and is used as a model by other states. The program received new funding to expand outreach on management-intensive grazing practices.

During FY 2004, UVM Extension and VT-AES research and outreach programs helped the dairy community maintain overall milk production for the state, despite a loss of 6% of farms during the period of a long-term price drop. UVM Extension shared UVM and other research information through workshops, farm visits, conferences, and website development to assist dairy farmers. During FY 2004 these efforts:

- helped 150 large farm dairy operators improve farm profitability within one year by organizing and hosting a Large Farm Dairy Conference; 80 farmers stated these changes improved their quality of life;
- saved 115 farmers between $100 and $3,000 within one year by helping them to improve pasture management techniques associated with mechanical harvesting and manure handling, thereby decreasing equipment and fuel costs; changes also increased revenues as consumer awareness increases about the environmental and nutritional benefits of purchasing meat and milk from grass-fed animals;

- helped more than 150 farmers to improve business practices to increase profits, with 70% able to report increases of $500 or more within six months after changes were implemented
- reduced somatic cell counts from unhealthy to healthy levels on two dairy farms, and rewarded farms with low somatic cell counts at key farm events

DIVERSIFIED AGRICULTURE AND NICHE MARKETS

The growth and success of diversified farming enterprises has allowed for the maintenance of approximately the same number of acres in agriculture, despite loss of bovine dairy farmland, over the past decade. UVM Extension and VT-AES continue to modify efforts to reflect this change in agriculture for the State.

- Evaluation results from a UVM Extension-hosted Sustainable Agriculture Conference show 700 farmers anticipate information gleaned will directly improve farm profitability.
- Use of foliar analysis has provided 35 berry farmers with recommendations regarding trace elements that would have not otherwise been detectable, leading to improved production.
- More than 1,400 maple producers in Vermont, the northeast, and Canada have reported benefiting from maple-oriented workshops and conferences by adopting new techniques inviting the use of new technologies that improve and ensure pure product quality. Additional maple research is helping maple growers to identify high-yielding trees during early growth and better predict timing of sap exudation through a climate-based systems dynamics model.
- More than 40 farmers are adopting cover-cropping practices expected to increase soil health and reduce reliance on pesticides.
- Other research in this area is helping determine how dairy manure compost can be amended as a successful root substrate for the production of vegetable transplants, thereby reducing soil treatment costs for diversifying farmers, and studying rhizobomous plants for the development of non-legumes that can grow in the absence of commercial fertilizers.

Conscientious consumerism is creating new markets for farmers, including those for organically produced products, products grown using fair trade policies, genetically-modified-ingredient-free products, and locally produced goods. Organic food is the fastest growing segment of agricultural sales in the United States, increasing by approximately 20% each year for the past several years. The number of Vermont state-certified organic farms has quadrupled in the past decade, and organic farming now represents 6,123 acres of Vermont farmland. This represents a 34% growth in certified organic acreage since 1999. Gross sales from certified organic farms in Vermont totaled over $27 million, with $15 million in sales directly from farms. Organic milk receives significantly more than for conventionally produced milk, thereby increasing profits for some Vermont dairy farmers.

The trend toward increasing consumption of organic products complements Vermont's efforts to strengthen an already strong Vermont "brand" on exports and maintain an environmentally sound working landscape. It has been shown that retailers can ask an average of up to 15% more for products with a Vermont label, and Vermont organic products have become increasingly common on store shelves along the East Coast and beyond. Additionally, the potential market for functional foods, a phrase to describe commodities with new or unique health or nutritional properties, is massive. In 2002, the functional foods market was a $20.2 billion business with an anticipated growth rate of 7-10% a year. Impacts of VT-AES and UVM Extension efforts this past year include the development of soy-based functional foods, establishment of a seed improvement organization

by 15 participants of an outreach program in order to maintain high quality public grain seeds for organic farmers; conducting surveys showing Vermont consumer interests and behaviors for foods, including concerns and purchasing decisions regarding genetically modified foods, organic foods, and foods produced using fair trade policies.

It is in these ways that UVM Extension supports a healthy and diverse agriculture linked to healthy communities and the natural environment.

KEY THEME: PRECISION AGRICULTURE

PRECISION AGRICULTURE FOR FRUIT GROWERS – The best way to manage the fertility of small fruit plantings is to take leaf samples and have them analyzed for their nutrient content (foliar analysis). Yet, few growers in Vermont utilize this procedure. For several years, a UVM fruit-grower outreach specialist has been explaining and promoting the benefits of foliar analysis as a means of enhancing small fruit productivity and profitability, while avoiding unnecessary fertilizer applications. This year, for the first time, there was a significant increase (20%) in the number of growers submitting foliage to the UVM Agricultural Testing Lab for testing. Based on these analyses, specialists provided fertilizer recommendations for nearly three dozen plantings on over a dozen different blueberry, raspberry and strawberry farms. The vast majority of these were in need of trace element fertilization, which would not have been apparent without this process.

Funding: Smith-Lever

Scope of Impact: Multistate

PREVENTING CORN ROOTWORM OUTBREAKS – Field corn growers in Vermont are primarily dairy farmers whose major focus is often on the animals rather than the crops. Although entomologists and agronomists have recognized the Western and Northern Corn Rootworms as a serious problem in the northeastern U.S., it is often challenging to know if information disseminated to dairy farmers about this insect and its management has been effective. Based on the survey conducted at four Field Crop Integrated Pest Management Meetings over the past two years (62 farms representing about 9% of the corn acreage grown in Vermont), over 72% of the respondents surveyed stated that their decisions for scouting and managing the corn rootworm insects were based on “some” to “a lot” of the information presented at these meetings. When asked if they would be scouting for rootworms in 2004, 87% stated that they would be scouting for symptoms (e.g., goosenecking), while 76% would also scout for beetles, indicating a high level of behavioral intent achieved through workshops that will help reduce the likelihood of corn rootworm infestations.

Funding: Smith-Lever

Scope of Impact: Statewide

KEY THEME: DIVERSIFIED/ ALTERNATIVE AGRICULTURE

MEETING DIVERSE FRUIT PRODUCER NEEDS – UVM coordinated, with the help of 28 steering committee members from across New England and eastern New York, representing Cooperative Extension, Connecticut Agricultural Experiment Station, grower associations, and

industry, the combined 2003 New England Vegetable and Berry Conference, New England Fruit Meeting, and Trade Show, held December 16-18 in Manchester, New Hampshire. The three-day program offered 120 thirty-minute educational presentations in 24 separate sessions that focused on a wide variety of crops, cultural practices, production techniques, and marketing methods, and more than 100 trade show exhibits. New this year and quite popular were several 'farmer-to farmer' discussion sessions on topics such as labor management, transitioning to organic, and cut flower production. One thousand three hundred and forty eight (1,348) people, including 285 people associated with the trade show, attended the conference. Of the 231 people returning evaluations:

- 97% reported that the educational sessions were good or excellent;
- 90% stated the trade show was good or excellent;
- 90% found new sources of information; and
- 82% expected farm profitability to improve;
- 88% reported their soil or nutrient management would improve;
- 92% of respondents reported their pest management practices would improve;
- 79% reported they planned to implement a new practice in the coming year as a result of the conference.
- More than 235 growers received Pesticide Recertification credits, which assists them professionally and improves farm quality and safety.

Funding: Smith-Lever

Scope of Impact: Multistate

MANAGING MAPLE PRODUCTION – One in every four trees in Vermont is a maple tree. Vermont maple syrup production accounts for nearly 40% of annual national production and 50% of syrup produced in the six New England states. Vermont maple syrup produces $15 million in annual retail sales and more than ten times that amount in related economic and employment impact, with a strong effect on tourism, as a result of fall foliage from these trees. Consumers surveyed nationally consider the words "Vermont" and "maple syrup" as synonymous as Florida and orange juice. To further cultivate this image here and abroad, UVM research and outreach focus on making small and large operations profitable, safe, and able to produce the most pure syrup available on the market. As a result of workshops, trainings, and newsletters, such as Maple Mainline, offered to 2000 maple producers across the state, 70% of producers have adopted new techniques involving the use of new technology to improve and ensure pure product quality.

Funding: Smith-Lever

Scope of Impact: Statewide

BETTER SOILS, BETTER CROPS, BETTER ENVIRONMENT – Commercial vegetable farmers are interested in ways to enhance long term productivity of their soil while protecting the environment. Workshops on developing soil health have been well received, with the following results for the 92 participants:

- 90% stated that they intend to make changes to farming practices regarding soil, and
- 88% noted that the agronomy program offered to them through Extension would help them to make these changes.

- 60% had actually implemented changes within six months of the workshop, such as reducing tillage, adding more organic matter, diversifying crops, and rotating crops.
- One couple attending reported that the workshop provided them with the tools they needed to check soils and make appropriate decisions before making a planned farm purchase.
- Another farmer changed tractor routing practices with new information about how to reduce soil compaction.

A total of 115 people from Vermont and Connecticut attended a day-long presentation on innovative ways to use cover crops to improve soil health and reduce reliance on pesticides, with 90% planning to adopt new practices, and 32% stating they intended to add cover cropping as a practice they would adopt or improve. As a result of these successful efforts-and work with a team of agricultural professionals from across the Northeast to develop a proposal to enhance the knowledge and understanding of organic agriculture among extension and other service providers-outreach specialists were awarded a $120,000 grant from USDA-SARE to conduct professional development trainings in the classroom and the field at several locations in the northeast over the next two years.

Funding: Smith-Lever

Scope of Impact: Multistate

ORGANIC SOY-BASED PRODUCTS FOR FARM DIVERSIFICATION AND CONSUMER HEALTH – Dairy farming dominates agriculture in Vermont, accounting for nearly 90% of agricultural receipts. There is a need for both diversification of agricultural production, and simultaneous development of new value added food products. Soy foods are considered functional, healthy foods. Soy product consumption has steadily increased in double digits during the last four to five years. However, because of our eating habits and the flavor of soy products, the market share of soy food is much smaller than other major food categories. Several organic new soy-based products including low moisture tofu, fortified soy milk, and tempeh have been developed and tasted-tested by panelists. Symbiotic soy yogurt and beverage have also been developed. Chemical and microbiological analyses, shelf-life testing, and survivability of probiotics are being conducted. The new products developed by this research are intended to create new niche markets for Vermont organic soy farms, increase soy food consumption in Vermont, and benefit the wellbeing of consumers.

Funding: Hatch Act Funds

Scope of Impact: Statewide

CONSUMER ATTITUDES AND BEHAVIORS TOWARD FOOD PURCHASES – The 2004 Vermonter Poll was used once again to collect data on consumer perceptions, beliefs, knowledge, and behaviors associated with genetically modified foods. In addition, data regarding milk prices and availability of rBST-free milk were collected from a random sample of Vermont retail stores. Results show that consumers are both willing to pay for information and for genetically-modified-organism-free (GMO-free) foods. The willingness to pay for rBST-free milk appears to be higher than the premium currently charged in the marketplace. Only about 10% of consumers actively seek information related to genetically modified ingredients in food, though the percentage has increased. Multivariate analyses infer that consumer attitudes and knowledge are more important in predicting

consumer behaviors associated with genetically modified foods than are demographic characteristics. A side-study determined that the wording of questions also influenced respondents' level of support for consuming genetically modified foods. Further analyses address consumer behavior, policy, and technology, including whether labels send the intended signal to consumers who either are searching for, or trying to avoid genetically modified ingredients.

Funding: Hatch Act Funds

Scope of Impact: Statewide

VERMONT AS MARKET FOR SUSTAINABLY GROWN COFFEE ALTERNATIVES – This project helps to identify areas of potential market growth for alternative coffees and provide basic information for marketing campaigns. Socially and environmentally cooperative projects promote the steady supply of high quality coffees, improve the standard of living of coffee producing communities, and serve to promote Vermont coffee products nationwide. This project studied coffee consumers, companies, and retailers in Vermont, with a view to assessing the alternative coffee industry in Vermont. More Vermont adults drink coffee than the national average (73% versus 64%), and a higher percentage report consuming alterative coffees on at least an occasional basis than the national average (33% versus 5%). Interestingly, these high rates occurred in the absence of alternative coffee promotion by coffee shops in which the coffee was purchased. As expected, health, environment, and social issues are the most-often cited reasons for purchasing alternative coffees. Conversely, those who do not purchase them cited high prices, low availability, and lack of knowledge as their main reasons. Field trips across Vermont showed that alternative coffees are available at 49% of retailers, and close to 40% of the public has never heard of them, although 60% of respondents said that if they were told that alternative coffees are good for the environment, farmers, and consumer's health, they would increase their purchases. Results showed a strong correlation between the amount of education and the consumption of alternative coffees. Researchers expect that additional companies will take advantage of Vermont's environmental knowledge and perspectives, and its consumer reputation to engage in similar cooperative initiatives.

Funding: Hatch Act Funds

Scope of Impact: Statewide

DEVELOPING VERMONT AGRI-TOURISM – Travel and tourism is the one of the largest industries in the state of Vermont, second only to manufacturing, and contributes significantly to state income and local employment opportunities. However, the complexity of the interactions between tourism and other industries has added challenges to researchers when examining trade, employment, and economic impacts. This tourism research project followed an established framework developed at UVM to estimate (1) the demand of Vermont tourism; (2) relationship between labor market and Vermont tourism; and (3) interactions between agricultural enterprises and Vermont tourism. Results showed significant differences between Vermont visitors and the census U.S. households, in terms of household income, education, composition, and other characteristics. Significant expenditure differences existed among different purpose groups. The estimated expenditure elasticity corresponding to income for three groups (visiting family and friends, ski, and recreation) were positive and inelastic, and the values were different among groups. Visitors' geo-demographics had significant and different impacts on their expenditures. Results of

agri-tourism analysis revealed that farm respondents were young families, operated on a small scale with limited funds, and offered recreational products and services by season. Identifying an effective marketing strategy seemed to be most challenging aspect of developing tourism on their farms for Vermont farmers.

Funding: Hatch Act Funds

Scope of Impact: Statewide

KEY THEME: ORGANIC AGRICULTURE

ORGANIC FOOD INDUSTRY AND ITS POTENTIALS FOR IMPROVING FARM PROFITABILITY AND FOOD SAFETY – The organic food industry has grown into an important sector in Vermont and many other states in the United States but few studies have been conducted to assess the industry's potentials and constraints. This project, published in two journals, examined consumers' valuation of and willingness to pay for organic food products through a conjoint survey conducted in Vermont in 2002 and analyzed producers' concerns and needs for information through an organic producer survey conducted in Vermont in 2003. Results from the consumer survey suggest that consumers are willing to pay significantly more for organic food products like apples and milk produced in Vermont and that willingness to pay for organic products varies across regions and demographic groups. Results from the survey of Vermont organic producers also identified consumers' concerns and needs for information. Information from this study is useful to organic farmers, processors, retailers, consumers, researchers and policymakers.

Funding: Hatch Act Funds

Scope of Impact: Statewide

ORGANIC FARMER SUPPORT – Personnel in extension, research and other service organizations want to improve their ability to serve a growing constituency of organic farmers. In September 2002 UVM Extension helped to organize a professional development conference, "Working with organic farmers: improving agency involvement." A follow-up survey conducted in FY 2004, 18 months after the conference, got a 68% response rate from 118 attendees, and revealed that:

- 59% feel that attending the conference helped them to plan or implement a program for organic farmers; and
- 92% reported that the conference yielded other benefits including enhancing their communication with others interested in organic agriculture.

Funding: Smith-Lever

Scope of Impact: Statewide

GROWING ORGANIC GRAINS AND FORAGE – Vermont farmers are attracted to growing organic grains because of the potential for increased profits from product sales and reduced feed costs for their animals. After a successful workshop with 35 participants from all around New England, two additional workshops were held for 105 participants, 70% of whom reported increasing their knowledge about planting, production, and storage of organic grains, and 43% of

whom reported that the program helped them to implement new practices that will improve their organic grain production goals. One third generation Vermont dairy farmer summed his changing views this way, "I now know that … good, healthy soil translates into healthy high yielding crops and healthy high producing cows." After participating in a soils course, mentoring program, and organic grains workshop sponsored by UVM, this farmer changed several cropping system practices that translated into economic, environmental, and social benefits for his farm. A group of 15 committed participants has launched a seed improvement organization in order to maintain high quality public grain seeds for organic farmers, and future workshops are being designed to meet farmer interests on the topic.

Funding: Smith-Lever

Scope of Impact: Statewide

KEY THEME: AGRICULTURAL PROFITABILITY

IMPROVING PASTURE YIELDS – As livestock are fed on pasture, a greater proportion of local money is spent on local products and services. Ripple effects generate $1.50 to $2.80 to a community for each dollar spent by farmers within the local economy. Since little information about pasture production exists for Vermont farmers, and in order for farmers to take advantage of Vermont's 33,737 hectares of high-yield pastureland, researchers investigated soil health characteristics and treatment recommendations. The study determined the effects of irrigation, nitrogen fertilizer, and organic soil amendments on pasture forage yield and quality under rational grazing management. Two years' results indicate that irrigation is desirable at the rate of 1.5 centimeters per week, depending upon seasonal rainfall. Applying compost or organic nitrogen fertilizer benefits forage yield and quality. Compost application had the most beneficial effect on yield and legume content of fields. The extra forage obtained is worth at least $200 per ton. Another benefit is obtained by clipping after each grazing; this practice maintains the field at a high level of quality for subsequent grazing periods.

Funding: Hatch Act Funds

Scope of Impact: Statewide

IMPROVING FORAGE CROPPING MANAGEMENT – Fluctuations in milk prices and feed costs have forced dairy farmers to become more efficient with their farm operation. In lieu of the current situation, some farmers have opted to transition from conventional to organic dairy farming. Regardless of the way a producer farms, high quality and economically feasible forage crops are an important factor in dairy profitability since approximately one-half of the total cost of milk production is feed related. Properly planned and managed cropping systems will not only produce high quality forage but also benefit the soil, allow for weed/pest control, promote diversity, as well as be economically feasible. Five farmers were recruited as part of a study to integrate new forage crops and receive consultations about forage production management. In return, farmers kept records on production yields, quality, and the benefits and pitfalls of integrating these new forage crops. Although mixed results occurred (quality was high, but yield lower than expected), three of the five farmers plan to continue integrating the new forage crops, and all felt it was enough of a worthwhile endeavor that they each told at least two other farmers about the experience.

Funding: Smith-Lever

Scope of Impact: Statewide

VERMONT PASTURE NETWORK OUTREACH PROGRAM – Since 1996, the Vermont Pasture program, run through the UVM Extension-sponsored Center for Sustainable Agriculture, has been a model of successful collaboration between farmers and agencies. This collaboration has provided technical education and support to a large number of farmers and agency personnel with a relatively small amount of funding, and has had a significant impact on promoting and supporting grass-based agriculture in Vermont. Since its inception in 1996:

- Membership in the network has increased to 215, and hundreds of other farmers participate in discussion groups, pasture walks, and conferences.
- Since 1996, 521 farmers and 32 agency personnel have attended 33 educational pasture walks, and 120 farmers have attended one or more of 250 discussion groups offered.
- Interest in and demand for more grazing information is growing, and is now coming from all types of livestock farmers.
- Vermont annual grazing conference participation increased from 176 to 380 attendees over the past five years, and this now represents the second largest farmer conference held each year in the state of Vermont.
- Many other states are now looking at the "Vermont Model" as they begin to set up their own pasture programs.
- Due to its success, the UVM Center for Sustainable Agriculture and Northeast Organic Farmers' Association of Vermont (NOFA-VT) received new funding for the Vermont Pasture Network to expand the farming practice of Management Intensive Grazing.

Funding: Smith-Lever

Scope of Impact: Statewide

HAY, THERE'S THE BEEF! – The largest cost of beef production is feeding herds over the winter, and the largest component of winter-feeding is hay. Higher quality hay than needed is often purchased, reducing beef producer profits. A hay quality workshop attracted 23 participants, where analyzed bales of hay and hay lab samples were available for viewing, and where five participants had their forage analyzed for quality based on tons of dry matter.

- 23 participants learned it is less cost effective for beef producers to purchase small rectangular hay bales.
- One participant used program information to save more than $600 by not ordering three tons of grain he planned to order.
- Information helped reduce hay bills for other participants by between 25 to 50% as they switched to feeding round bales over rectangular bales.

Funding: Smith-Lever

Scope of Impact: Statewide

APPRAISING THE USE OF TECHNOLOGY AND PRODUCTION PRACTICES ON VERMONT DAIRY FARMS – A survey was conducted in order to provide the most current information to UVM Extension, USDA agencies, and the Vermont Agency of Agriculture, Food, and Markets knowledge on the current status of the Vermont dairy industry, and how changes have occurred over the past five years with respect to farm size, production per cow, and operator characteristics, including technology use. The mail survey generated a response rate of 60% for 1455 known dairy farms. Results show the following data about the status of technology on Vermont dairy farms:

Milking System	% of Farmers Using System	Average Herd Size (number of cows)	Average Pounds of Milk Produced Annually
Round-the-barn pipeline	53.2%	68	16,990
Milking Parlor	39.3%	196	18,785
Pail unit	7.5%	37	13,135

- More than one-third of Vermont's dairy farms use milker unit take-offs (36.7%); such farms averaged larger herd sizes and production rates (203 cows and 19,155 pounds of milk per cow). Only 15% of farms with pipelines use automatic takeoffs.
- Nearly half of the state's dairy farms are using totally mixed rations (TMR) (47.8%), with two-thirds of those using milking parlors.
- There are a considerable number of herds with more than 100 cows without a manure pit.
- More than one third of dairy farms use custom manure hauling (35.5%) and rely on a crop management consultant (29.4%). These farms average 160 and 142 cows per farm, respectively. These farms also had milk production nearly 1,500 pounds above average.
- The use of bST (bovine somatotropin, or bovine growth hormone) remains a controversial issue in Vermont with only 11.1% of the state's farms reporting use of the hormone. These herds account for nearly 25% of the state's dairy cows and more than 30% of the state's milk production. These cows produce more than 3,000 pounds of milk per cow above the state average. The controversy over bST may have affected the response on this question.
- Record keeping systems are closely associated with higher milk production. The 46.5% of the farms that kept records averaged 130 cows and sold 19,040 pounds of milk per cow. In the same context, computers are used for financial records on 39.4% of the farms.
- Many smaller Vermont dairy farms have adopted some technologies that have enabled them to compete with their larger neighbors. In addition, milk production and herd size are not necessarily related to profitability. While the use of some technologies is necessary for larger herds, profitability is not automatically guaranteed.

Information from this survey is being shared with agencies and farmers to improve prioritization of operations and outreach needs.

Funding: Hatch Act Funds

Scope of Impact: Statewide

MASTITIS GENE THERAPY -- VT-AES researchers are active participants in a study of mastitis-resistant animals involving colleagues from 13 states as well as Canada and England. This work has led to scientific breakthroughs that could significantly improve animal health and welfare and potentially save the dairy industry millions of dollars. The key to these scientific advancements has been the cloning and modification of a gene that helps destroy bacterial cells that cause mastitis. UVM researchers changed the lysostaphin gene sequence so that the protein would be manufactured directly, and only by an animal's mammary cells. The UVM gene has been used successfully in a collaborative effort with scientists at the Beltsville, Maryland, USDA laboratory, who have produced mice that are resistant to mastitis. USDA and Vermont scientists also are working with the UVM gene to produce a mastitis-resistant cow. "The beauty of lysostaphin is that it only attacks the staphylococcal bacteria that cause mastitis. It has no impact whatsoever on other cells," says John Bramley, lead researcher. Bob Wall, a USDA research physiologist collaborating with the UVM scientists, states, "We have had this goal, since the technology became available, to improve milk production characteristics of farm animals to benefit the animal, the producer, and the consumer. UVM has come up with the potential gene needed to do this."

Funding: Hatch Act funds

Scope of Impact: Multistate

DAIRY HERD MANAGEMENT – Elevated herd somatic cell counts (SCC's) reduce herd immunity to disease and ability to receive quality premiums on milk produced. UVM Extension helps dairy farmers to maintain SCC records, culture blood samples, and provides appropriate recommendations for farmers based on results. By recognizing the culprits as environmental Staphylococcus and Streptococcus, researchers determined that one farmer should treat a cow producing the highest chronic cell counts and not change milking procedures, instead hiring a milker who can follow the procedure correctly, and improve consistency of the milking preparation routine. The farm now receives quality premiums on milk shipped. Another farmer adopting Dairy Herd Improvement recordkeeping for the first time asked at a follow-up visit, "Why didn't we do this years ago? Finally we really know." Twelve of 100 cows were on the "hot list". The farmer successfully followed Extension recommendations and took the extra step of asking for additional information and a follow-up visit.

Funding: Smith-Lever

Scope of Impact: Statewide

BEEF AND SHEEP FARM SUPPORT – As a result of two UVM Extension outreach personnel-directed workshops, newsletters, and website development efforts:

- Fifteen beef farmers are now participating in natural beef markets, and report greater net returns for their cattle than those not using these markets.
- Sheep shearing classes improved sheep shearing skills for 30 sheep shearers across the state.
- Management improvements have occurred as 50% of Vermont sheep and beef producers now maintain records electronically.
- Outreach specialists developed a web site guide using "real" producer photographs and stories, and built in several navigational aids to help the new producer find the basic information about starting a sheep flock in Vermont. Many phone and email consultations

deal with start-up sheep farmers requesting similar information, so in addition to being a useful resource for farmers, the website produced represents an efficiency-oriented tool for Extension use. Of particular interest to the farmer is an interactive budget created to allow the producer conduct “what-if” analyses on-line. The Beginning Sheep Guide is getting at least 30 "hits” per week from non-university users. Developers have found other universities are linking to this site, and the Google search engine lists the site in its top 3 sites when searching for "sheep budget". While hits are not proof of usage, the continued visits and high search engine ranking suggest people are using the information on the website.

Funding: Smith-Lever

Scope of Impact: Statewide

LARGE DAIRY FARM MANAGEMENT SUPPORT – Nearly 200 farmers from more than 60 Vermont farms attended the 2004 large Dairy Farm Conference. Based on a written post-evaluation of the 2004 conference:

- 100% of respondents reported they "might" or “will” make a management change that will improve their farm profitability as a direct result of attending the conference; and
- 93% responded that they "might" or “will” make a management change that will improve their quality of life.

Follow-up evaluation responses from participants attending the 2003 Large Dairy Farm Conference indicates:

- 75% of participants made a management change that improved farm profitability; and
- 73% of those making a change reported that doing so improved their quality of life.

Funding: Smith-Lever

Scope of Impact: Statewide

FARM SAFETY – The UVM Extension Farm Safety specialist, in collaboration with the Vermont Agency of Agriculture has initiated a "large dairy farm" safety check, which requires developing a Farm Safety Plan and an employee training program for each participating farm. In this pilot project, twelve large dairy farms voluntarily signed up for this educational program. Required follow-up employee training conducted by the new Farm Safety Officer and the development of a Farm Safety Plan were a major step ahead on most of these farms.

- Nearly 100 farm managers and employees completed the farm safety training, where participants shared their experiences and safety concerns, learned tricks of the trade. Three of the farms employed Hispanic migrant workers and special accommodations were implemented to ensure that all employees could comprehend the safety training message.
- 80% of these farm workers feel they will work more safely on farms as a result of program participation.
- 200 maple producers attended a Nova Scotia conference including a safety-oriented workshop led by a UVM Extension faculty member; 80% stated they would adopt at least one new practice they learned about which would make their operation safer for them.

UVM's Rural and Agricultural Vocational Rehabilitation (RAVR) program assisted more than 350 Vermont farmers over the past five years, enabling them to continue farming operations, many of which may otherwise have become unprofitable and possibly require selling the farm. The program has also assisted those who cannot remain in farming to make a living that supports their household. A recent survey of 80 program consumers showed an 82% overall satisfaction rate. Selected measures of satisfied or very satisfied clients include: control and involvement in vocational rehabilitation service (89%); choice of available services (90%); choice of providers (93%); length of time to have questions answered (94%); helpfulness of staff in reaching your goals (94%); ease of contact with counselor (97%); office accessibility (100%). Most clients surveyed stated that they agree or strongly agree that services helped them to become more financially independent (77%); they were treated with respect (100%); and the agency helped them reach their job goals (88%).

We also serve the only multistate AgrAbility audience, working with New Hampshire to identify and analyze cases of shorter-term disabling events affecting farmers, and assisting them through these crises, preventing loss of farms and livelihoods. This program augments and uses the same protocols as UVM's RAVR program, nationally recognized for excellence in client-reported outcomes and efficiency of case closings. The AgrAbility program enables UVM Extension to assist people who face a disabling event-oriented crisis, but whose injuries or ailments do not meet the rigorous, long-term definition of "disabled" set by RAVR. In its first year, Vermont's RAVR and AgrAbility programs completed 100 farm site assessments, completing cases for nearly 90 farmers in the process.

Funding: Smith-Lever

Scope of Impact: Multistate

HELPING FARMERS MAKE INFORMED BUSINESS DECISIONS – Strengthened by a Vermont Housing and Conservation Board grant of $123,000 to hire two positions, an agricultural viability program conducted more than 200 workshops and/or visits to dairy farms by four farm outreach specialists. Efforts resulted in the following impacts:

- 73% of farmers visited report that they will use the information to improve farm management.
- More than 7 farms have implemented recommended changes in at least two of three priority areas defined.
- More than 5 farms reported at least a $500 increase in profits due to changes made.
- Using the financial software for farm management, FINPACK, a series of visits with a farm family planning to sell their herd of cows led to a more satisfying decision for the farm family.
- 36 participants in this year's Ag Business Management course now know the production costs for their farms.
- 20 business plans are being developed, out of a proposal process that received 60 farmer proposals.
- 55% of 10 beginning farmers who participated in this year's NxLevel course developed business plans to begin or modify an agriculturally based business upon completion of course.
- 25% of beginning farmers with plans are already utilizing the plan.

- 90% of 410 participants in this year's Income Tax workshops report that they will provide clients with more accurate tax returns in a shorter period of time as a result of participation.
- 90% of 36 participants in a crop insurance workshop report knowing more about the values and costs when considering purchasing of crop insurance.
- Workshop participation helped a farmer to figure the cost of producing wholesale green beans to increase profits, and a sheep cheese producer to calculate the total value of his farm assets, and begin thinking about ways to use financial records for planning.

Funding: Smith-Lever

Scope of Impact: Statewide

DEVELOPING SUSTAINABLE AGRICULTURE IN VERMONT – UVM Center for Sustainable Agriculture, directed by Extension, hosted the two-and-a-half day 2004 Northeast Sustainable Agriculture Research and Education (SARE) Conference, which drew more than 600 attendees representing 39 states and Canadian provinces. Conference participants joined bus tours of selected Vermont farms, and then attended any of 25 educational sessions over the next two days. Organized in five "tracks", sessions focused on marketing, production, policy, communications and exemplary farmers. Of the 34% of conference-goers who returned evaluation forms:

- 99% stated they received useful information or contacts by attending;
- 93% said they were made aware of a new source of useful information;
- 88% said the conference will help them promote sustainable agriculture to others;
- 87% said they got some new ideas about sustainable agriculture;
- 84% said their knowledge of SARE programs and projects was increased;
- 80% said their understanding of sustainable agriculture was enhanced; and
- 66% of respondents said the conference would lead them to do something new or different in the coming year.

Funding: Smith-Lever

Scope of Impact: Statewide

IMPROVING COMMUNICATION TOOLS FOR AGRICULTURAL INTERESTS – The internet has changed the way that citizens 'shop' for information and farmers are among the audiences increasingly looking to the internet for information. A committee of UVM Extension program coordinators and web specialists designed a new version of the UVM Extension web page. The new version places an emphasis on content. It also provides a more coordinated way to present educational opportunities to interested farmers and begins to show the inter-relationships between the dairy and diversified agriculture teams. The new web site is a great improvement over the previous version and should serve as a vital educational tool for Vermont farmers. Improved user-friendliness should increase both the number of individuals using the site and the amount of information they download from the site. One hundred hits on the site lasted at least five minutes, indicating depth of site use.

Funding: Smith-Lever

Scope of Impact: Statewide

VERMONT GROWN COLLABORATIVE – The Locally Grown Collaborative is a statewide effort involving 12 stakeholders and regional grass-roots organizations to design a statewide "buy-local" campaign to help farmers and consumers sustain their livelihoods. Vermont's Sustainable Agriculture Network was formed to support a more unified and focused strategy for developing local food systems, connecting consumers with local farmers and their products, and increasing the income of the Vermont agriculture communities. On behalf of the Vermont Sustainable Agriculture Network (SAN), the Department of Community Development and Applied Economics (CDAE) and the Center for Rural Studies (CRS) at UVM, conducted preliminary research through multiple survey analyses and focus groups to examine Vermonters' perceptions and purchasing of local food. The study was designed to provide information that will assist in the direction and marketing efforts for the Vermont Locally Grown Collaborative. Through bivariate and regression analysis of the survey results, this study found:

- Local food expenditures have the potential to increase regardless of how much a consumer is currently spending on local food products.
- Lower income consumers buy a different array of products than do higher income consumers, and are less likely to buy directly from the farmer.
- Consumers' expenditures on non-local organic food products compete with expenditures on local non-organic food products. Food products that are both organic and local may have a niche in the market.

Focusing the campaign on increasing consumers' attitude towards local should increase purchases of meat and fish, vegetables, candy, beverages and herbs. The 40 participating Vermont farms this first year all reported increased success for their enterprises, with 61% also enhancing value-added enterprises.

Funding: Hatch Act Funds and Smith-Lever Funds

Scope of Impact: Statewide

KEY THEME: RISK MANAGEMENT

PROGRAM EXPANSION AND SUSTAINABILITY EFFORTS – As a smaller Land Grant University with continued funding challenges, UVM Extension has expended tremendous effort to provide the necessary funding to maintain critical program areas. Examples of this effort and resulting successes include:

- $46,000 secured for Dairy Programming from USDA Risk Management Agency;
- $239,000 for Crop Insurance Education from USDA Risk Management Agency;
- $230,000 for reducing phosphorus contamination of water sources from USDA/CSREES/NRI;
- $21,500 for Farm Transfer Education in New England from Northeast Center for Risk Management Education; and
- $4700 for computer equipment from USDA Rural Development Agency.
- More than $269,000 was procured by the Center for Sustainable Agriculture to support Vermont Pasture Network, Land Link Vermont, New Farmer Network and Small Ruminant

dairy programs, from sources ranging from private donors to Heifer International to Ben & Jerry's to a joint project with the Department of Energy and USSA.

- $194,000 in research funds were secured for the next 3 years by UVM's Center for Sustainable Agriculture (CSA) for work in small ruminant nutrition as well as addressing the legal issues confronting farm families as they transfer farm ownership. UVM's CSA is also working on several multi-state projects that bring partial funding support to UVM.
- $11,000 was raised to develop a Dairy Profitability Enhancement Program (DPEP) to support Orleans County farmers.
- $168,000 in Ag Viability funding was secured through a grant with the Vermont Housing and Conservation Board to support development of business plans for 20 farmers determined from farm SWOT (strengths, weaknesses, opportunities & threats) analysis. Other applicants received assistance from Extension specialists and technical assistance providers in areas of farm transfer, diversification, record keeping, and production assistance.
- The Center for Sustainable Agriculture was selected as the New England Board of Higher Education 2005 Higher Education State Merit Award for Program Achievement.

Funding: Smith-Lever

Scope of Impact: Local, Statewide, and Multistate

KEY THEME: PLANT PRODUCTION EFFICIENCY

PREDICTING FORAGE QUALITY – The critical first step has been reached to developing an affordable, practical, and reliable method for predicting forage quality of the first harvest that can be used as a management tool by dairy producers in Vermont and other Northeastern States. Using a randomized block (with randomly located subplots) design, researchers found that the most consistent linear correlation for cultivars, years and locations occurred between acid detergent fiber and accumulated growing degree-days. Additional field testing of 19 forages and mixed-forage plots over three years showed that when growing degree-days was used as the prediction variable, up to 89% of the fields were accurately predicted for acid and neutral detergent fiber. However, when time (days) was used as the prediction variable, only 62% of the fields were accurately predicted. Data collected from these trials will be used in developing a forage quality prediction model for the first harvest of cool season grasses and alfalfa, which will improve dairy production and profits.

Funding: Hatch Act Funds

Scope of Impact: Statewide

IMPROVING CORN SILAGE THROUGH INTEGRATION OF FORAGE FENUGREEK – A movement towards larger dairy farms in the Northeast has led to widespread adoption of monoculture silage corn production. Crops grown in monoculture can have negative impacts on the environment and plant production cost efficiency. Our objective is to develop an economically, agronomic and environmentally sound management system for forage fenugreek as a feasible rotation with corn silage in the Northeast. Field trials showed that fenugreek yields were similar to alfalfa yields, but disease problems lowered the forage quality. Continued research will investigate the likelihood that introducing alternative high yield and quality annual forage crop to the Northeast will lead to more extended rotations and produce a number of beneficial rotation responses.

Funding: Hatch Act Funds

Scope of Impact: Statewide

DAIRY MANURE COMPOST EFFECTS ON ROOT ARCHITECTURE AND GROWTH OF VEGETABLES – Sweet corn (Zea mays L.) is regarded as difficult to transplant because of poor root regeneration and a greater shoot to root ratio. Despite reduced yields, growers are transplanting sweet corn to hasten maturity time to target profitable early markets in the Northeast. Researchers have ascribed the negative impacts on yield to restricted rooting volume. Therefore, the impacts plug cell volume had on sweet corn transplant root architecture and biomass accumulation were investigated. Temptation sweet corn was sown in different volumes, and plug cells were exposed to three substrate environments; a dairy manure based organic compost media, a commercial soil-less germination mix, and the soil-less media supplemented two times with organic fertilizer. Results showed that increasing cell volume before transplanting significantly increased root surface area, average diameter, and root volume after transplanting. Root environment also significantly impacted shoot and root biomass production, and continued to have a significant effect on root biomass production after transplanting with 22 percent greater accumulation. A large field experiment examining the relationship between plug cell size, compost amended soil with final sweet corn yield and quality is being further analyzed. Detailed information on sweet corn transplant production dynamics will allow small scale vegetable producers to improve production and target early profitable market times. Results from the evaluation of composted amended transplant media will also allow farmers to make informed decisions on the utilization of local inputs especially if the vegetable operation is in close proximity to a dairy. In the right circumstances, dairy manure compost amended media can be successfully used as a root substrate for the production of vegetable transplants.

Funding: Hatch Act Funds

Scope of Impact: Statewide

GRAFTING SUGAR MAPLES TO IMPROVE SALT TOLERANCE – Seeds of sugar maple and sycamore maple were collected in fall 2003 and stratified over the winter 2003/2004. The seeds were planted and resultant seedlings appropriately grafted such that we had scion-rootstock grafts (upper-lower plant portions) which resulted in the following combinations: sugar-sugar, sugar-sycamore and sycamore-sycamore grafts. Grafted plants are currently being grown in the greenhouse and will be over-wintered in a cool greenhouse. In spring 2005, the plants will be "challenged" with selected levels of salt water applications to determine the effects the salt-tolerant sycamore maple rootstock has in conferring salt tolerance to the sugar maple scion (upper portion) of the grafted plant. Grafted sugar maple onto urban-tolerant sycamore maple rootstock may provide a way to introduce these desirable ornamental species into urban areas in the Northeastern and upper mid-western states.

Funding: Hatch Act Funds

Scope of Impact: Statewide

IMPROVING APPLE CULTIVARS FOR VERMONT – Multidisciplinary evaluation of new apple cultivars will provide critical information to help the North American apple growers compete in a rapidly changing global fruit market. This was the fourth production year for 1999 planting and the horticultural and fruit qualities that may make some of these cultivars acceptable to Vermont apple growers are becoming more apparent. Based on previous and current year's data and personal preferences, there are three cultivars in this planting that are recommended for commercial planting on a limited basis: Zesta is a high quality, very attractive early-season variety with good sweet-tart flavor, recommended for the Paulared growing period; Silken is a high yielding cultivar with very low drop, and its fruit has a mild-sweet flavor; Pinova has a very well balanced sugar-acid flavor with a wonderful aromatic scent.

Funding: Hatch Act Funds

Scope of Impact: Statewide

DEVELOPING HIGH-QUALITY APPLE ROOTSTOCKS FOR VERMONT – The cost to establish or replant one acre of apples for commercial growth is estimated to be $17,000, and years of growth prior to any commercial harvesting. Therefore, growers place a high premium on selecting appropriate rootstocks that are adapted to Vermont's challenging climate and pest conditions, produce high quality fruit and high yields, and can compete successfully in the market place. Results of long-term rootstock studies indicate that the CG series outperforms the EMLA series in precocity and yield. Further assessment of winter damage will allow researchers to improve on genetic selection practices to develop apple trees more capable of surviving and maintaining steady crop production in cold climates.

Funding: Hatch Act Funds

Scope of Impact: Statewide

DEVELOPING PLANTS TO MAKE THEIR OWN FOOD – The unique properties of legume development permit these plants to interact with nitrogen-fixing rhizobium bacteria. A better understanding of plant properties permitting these interactions can lead to the potential for the development of non-legumes that can grow in the absence of commercial fertilizers. Researchers initiated a series of experiments designed to identify differences in lateral root development and physiology between legumes and non-legumes. Researchers identified a difference in the regulation of root architecture (root branching) between legumes and non-legumes that correlates with branches of the phylogeny that have the ability to nodulate. Results provide the first evidence for a specific physiological trait that correlates with the ability to form nitrogen-fixing root nodules. This information may be transferable to research efforts to produce non-leguminous nitrogen-fixing plants, thereby reducing producers' needs to purchase and apply certain fertilizers.

Funding: Hatch Act Funds

Scope of Impact: Statewide

PREDICTING TIMING AND QUALITY OF MAPLE SAP EXUDATION – Global change may affect agricultural processes and production. Maple sap production is highly sensitive to weather

conditions during the sugaring season (February to April), and thus would be expected to be impacted by changes in regional climate. This study examines the effects of global warming on maple syrup production by examining historical production records and developing a computer model of the relationship of sap flow to meteorological conditions. Historical data on timing of the maple sap flow season show a shift towards earlier in the year for both season start and season close, however the start and end times are not parallel, therefore the season duration is also decreasing. A more intensive survey is complete, and data analyses are in progress. A Stella-based computer model to simulate sap flow in maple trees is currently in development. This research attempts to determine the current and potential impacts of global warming on maple sap production in North America. By understanding the changes that have occurred, and those that may be expected to occur, management strategies may be devised to offset any impacts on maple syrup yield.

Funding: Hatch Act Funds

Scope of Impact: Statewide

PLANT AGE, ACCLIMATION AND FREEZING EFFECTS ON HERBACEOUS PERENNIAL HARDINESS– Three cultivars of Geranium were allowed to acclimate in an outdoor setting for different lengths of time in the fall of 2002 and 2003. Following freezing, plants were returned to the greenhouse. Plants were later rated for survival, bloom quality, and marketability. While some plants showed strong effects based on length of exposure to cold temperatures (e.g., 'Cambridge' plants), others showed minimal sensitivity ('Karmina' plants). `Dilys' (2003) showed significant effects from acclimation date and temperature, as well the interactions of these features. Detailed results will help growers better determine the effects of these variables on their own overwintering practices.

Funding: Hatch Act Funds

Scope of Impact: Statewide

KEY THEME: ANIMAL HEALTH

HEALTHIER CHICKS FOR LESS – MONEY AND POLLUTION, THAT IS: Nutritionists are increasingly formulating poultry diets with minimal protein levels supplemented with pure amino acids to achieve a better essential amino acid (EAA) balance. This practice actually increases the possibility of single amino acid deficiencies. Understanding how single and multiple amino-acid deficiencies affect growing chickens will help in adequately balancing low-protein diets that are supplemented with individual amino acids. A continuation of earlier work which showed that moderate to marked dietary deficiencies of essential amino acids (EAA) have differing effects on the endocrine system of growing chickens, this study examined the effects of milder to borderline EAA deficiencies, more comparable to those that might occur under practical conditions, and included more hormones. With all EAA deficiencies, growth in the pair-fed controls was almost always better than in the deficient chicks even though both groups consumed the same amounts of diet and energy. The study showed that even small deficiencies of essential amino acids, such as methionine, lysine, isoleucine, arginine and phenylalanine, can exert effects on avian growth and development through changes in the endocrine system. Data can be used to develop feeds having improved

nutrient balance, lower costs for chicken producers, and less environmental pollution through reduced nitrogen excretion.

Funding: Hatch Act Funds

Scope of Impact: Statewide

REDUCING MASTITIS IN DAIRY COWS – Infection of the bovine mammary gland is a continuing problem for the dairy industry and the welfare of dairy animals. This project will determine which genes are induced or repressed in bovine mammary cells in response to infection. We have developed a bovine epithelial cell culture system and identified a number of genes that are induced by infection of the cells. Furthermore, the infection response differs when the cells are exposed to different mastitis-causing pathogens. Identification of infection-responsive genes is a major step to understanding mechanisms that contribute to disease resistance. This knowledge will enable development of new strategies to protect the cow against mastitis, or perhaps to select for animals with enhanced natural resistance to infection.

Funding: Hatch Act Funds

Scope of Impact: Statewide

KEY THEME: ANIMAL PRODUCTION EFFICIENCY

UNDERSTANDING BOVINE MAMMARY GROWTH REGULATORS – Mammary growth and development is controlled by a complex system of interacting systemic and local factors. The tightly regulated release of these factors is critical to normal mammary development and milk production in the dairy cow. Researchers found that changes in the levels of transforming growth factor alpha and beta, both in vivo and in vitro, resulted in different rates of mammary epithelial and/or stromal tissue cell growth and death as well as regulated gene and protein expression, which in turn affected cellular microenvironment. Findings showed that TGF-beta can affect prepubertal heifer mammary development by regulating the composition of the supporting stromal tissue. Researchers speculate that TGF-beta1 stimulates bovine mammary gland development by providing a matrix for epithelial cells to grow in after stimulation of the stroma during prepubertal development. Thus, TGF-beta could be critical to milk production and warrants further investigation. This work, now in three peer-reviewed publications, gives dairy producers insight into the mechanisms involved in mammary growth and development, as well as advances in basic biology.

Funding: Hatch Act Funds

Scope of Impact: Statewide

ENHANCING BOVINE MAMMARY DEVELOPMENT TO IMPROVE MILK PRODUCTION EFFICIENCY – Using low-density single-stranded complementary DNA (cDNA) arrays as an initial screen and quantitative real-time polymerase chain reactions to determine gene expression profiles, UVM researchers have identified several genes involved in regulation of mammary development and function, providing new potential targets for development of treatments or optimized management strategies to enhance mammary development, milk production, colostral

quality and calf health. Several of these genes have not been previously studied in bovine mammary gland. These include several members of the SOCS family (suppressors of cytokine signaling), as well as the putative vitamin receptors, megalin, cubilin, folic acid receptor-alpha, and low-density lipoprotein receptor. Researchers conducted studies on the effects of the transition from gestation to lactation, hormonal induction of lactation, photoperiod and frequent milking, and have quantified effects of treatments or physiological stage on indices of mammary gland development and function. Studies and results include:

- experiments on photoperiod and frequent milking, which led to the identification of prolactin signaling as a possible common regulator of mammary function and milk yield;
- data that demonstrated exposure of cows to short-day photoperiod during the dry period resulted in significant effects on proliferation and apoptosis of mammary cells, particularly at about 20 days prior to parturition, indicating that the enhancement of milk yield shown to follow this treatment is due, at least partly, to changes in mammary development during the dry period;
- studies on the regulation of colostrum formation which indicates that identified receptors may function in transport of fat-soluble vitamins into colostrum and thereby influence calf health;
- research on pubertal heifers hormonally induced into lactation which demonstrated that exposure to short-day photoperiod before and during the hormonal treatment resulted in significantly increased milk yield relative to heifers on long-days, thereby confirming the stimulatory effect of short-days previously reported in dry cows.

Information can be shared with veterinarians, farmers, and other agents working with farmers to assist farm operations in optimizing environmental conditions to enhance long-term milk supplies and healthy cows.

Funding: Hatch Act Funds

Scope of Impact: Statewide

NATIONAL GOAL AREA 2: A SAFE AND SECURE FOOD AND FIBER SYSTEM.

During FY 2004 UVM Extension and VT-AES expended approximately 6.36 FTE's toward developing a safe and secure food and fiber system, an increase of more than one FTE from FY 2003, responding to increasing food safety, bioterrorism and security concerns. Efforts yielded 3,649 contacts, including 2,673 youth. A total of $546,831, or approximately 5% of total federal expenditures, were applied to National Goal Area 2.

Vermont's 6,500 farms need to be better protected from unintentional biosecurity risks and intentional attacks on the food system. Vermont's rural, decentralized infrastructure increases local vulnerability while decreasing statewide risks. However, much of Vermont's primary product, milk, is shipped out of state for processing, and is blended with milk from other sources before being distributed throughout the eastern seaboard. Therefore, Vermont milk sent out-of-state is vulnerable to problems introduced into milk supplies from other states. This and other farm biosecurity issues were addressed through discussion groups, online opportunities and surveys, and farm visits to learn from farmers about current conditions and provide information about best practices.

Each year, 6.5 to 33 million people suffer from symptoms of foodborne illness and 5,000 will die. Vermont does not currently require certification or licensing of food handlers, however there is a national trend towards certification and implementation of food safety systems (such as HACCP - Hazard Analysis Critical Control Points). These numbers are estimates because most food related illnesses go unreported. The cost of these illnesses has been estimated at any where from $10.0-83 billion a year in medical, legal expenses and work time loss. UVM has helped more than 1,662 current and aspiring workers in the food business to achieve food safety certification from a UVM Extension-developed, nationally recognized certification program, and has improved school sanitation practices for 4,000 students and 22 schools through youth and adult-oriented workshops, school-base and county fair-based outreach efforts.

Each year UVM gardening-oriented outreach programs provide over half a ton of additional produce for local food shelves. Over the past decade, program participants have donated more than 25 tons of fresh, local produce to food providers for income-limited families. Master Gardener volunteers last year provided five communities garden scholarship plots based on need, and partnered with "Plant a Row for the Hungry" to organize collection sites and Food Bank deliveries. Other programming toward the key theme "Food Access and Affordability" can be found under the Key Theme "Human Health" in the NGA 3 section of the report, since these programs emphasize access to healthy foods while also working to improve human health.

KEY THEME: FOOD SAFETY

FARM BIOSECURITY IMPROVEMENTS – Through use of Vermont Interactive Television (VIT), video production, five workshops, on-line surveys and in-person discussion groups, UVM Extension personnel educated 207 farmers and agency personnel of current and new biosecurity concerns, and practices they can employ to reduce the impact of these threats to their businesses. Survey results indicate:

- 75% of 207 participants increase their understanding of biosecurity concerns;
- 50% intend to change management practices in response to what they learned;

- 1 farmer had animals tested for Johne's disease, against veterinarian's recommendations; herd tested negative, offering farmer tremendous relief and sense of accomplishment
- information and assistance was helpful in identifying and solving a water-related biosecurity issue at a recent agricultural fair
- 18-minute video produced and available to educators and agri-service personnel; already incorporated into Animal Science undergraduate class

Funding: Hatch Act Funds and Smith-Lever Funds

Scope of Impact: Statewide

FOOD SAFETY AND SANITATION CERTIFICATION PROGRAM – Children are more vulnerable to foodborne illness because their immune systems are not fully developed. Many children in Vermont eat breakfast, lunch, and snacks at their schools. The UVM Extension, in partnership with Vermont Department of Education, developed a curriculum in Food Safety and Sanitation that was offered to school food service workers. The American School Food Service Association recognizes the ten-hour certification course. Since program inception in 1997, 1662 food workers have received training and 95% of participants have passed the knowledge and skills-based certification test after completing the program. Certification contributes to food service workers' eligibility for promotions and pay raises, providing a great incentive for workers to take the course. The education developed through a partnership between UVM Extension and the Vermont Department of Education is leading to safer and more sanitary school food environments for Vermont children.

Funding: Smith-Lever

Scope of Impact: Statewide

REDUCING DISEASE TRANSMISSION THE OLD-FASHIONED WAY – Research studies show that children and adults frequently fail to wash their hands even though they know they should. According to the Center for Disease Control, the most important thing you can do to keep from getting the flu, cold or a foodborne illness is to wash your hands. "Germ City" is a traveling exhibit designed to promote hand washing. Since implementing "Germ City" in FY 2003, more than 4,000 students from 22 Vermont schools and daycare facilities, 176 teachers, 100 para-educators, and 200 parents participated in the program. Evaluations showed that 80% of participants improved hand washing techniques and 50% improved their knowledge about when to wash their hands. Teachers from classrooms where Germ City has visited have stated that children who participate will later ask to wash their hands when they come in for recess and before they eat. One teacher from a Bennington school claimed that once a sink was installed in the classroom, a program recommendation, she noticed lower absentee rates occurring during flu season. An additional 2,500 participants in other diet and food-security oriented programs demonstrated proper knowledge of hand washing techniques and practices.

Funding: Smith-Lever

Scope of Impact: Statewide

GOOD AGRICULTURAL PRACTICES (GAP) PROJECT FOR SMALL PRODUCERS – UVM collaborated with New England states on a research and outreach program designed to improve producer food safety practices, and gauge consumer confidence in food safety. Consumer and grower surveys showed 22% of consumers were highly confident about the safety of fruits and vegetables they purchase, and 84% stated they would be willing to pay more for produce from GAP-certified farms. Microbial testing from farms yielded few samples with human pathogens. The research design called for New Hampshire to audit farmers on GAP practices and recommend changes, for two states (Rhode Island and Connecticut) to implement GAP certification and marketing programs, while three states (Maine, Massachusetts, and Vermont) were to offer workshops to deliver GAP information to producer audiences. Presentations were offered at a variety of venues (e.g., workshops, twilight meetings, grange events) and used a number of different media types (e.g., mailings, individual instruction, TV). Program participation in the voluntary program was limited as there was a lack of perceived urgency and perceived benefit by many producers. Positive outcomes include:

- 16 farmers earned GAP certification (Rhode Island and Connecticut);
- 14 audits were completed (NH), with farmers making one or more changes to operations; and
- states offering just workshops have not documented any program impacts, at this point.

Funding: Smith-Lever

Scope of Impact: Multistate

KEY THEME: FOOD QUALITY

ENSURING THAT PURE MAPLE SYRUP STAYS PURE – Maple syrup consumers can usually rely on a pure maple syrup product, in large part due to the continued efforts of the UVM research and outreach teams who develop inexpensive, effective methods to ensure the product remains free of contaminants, thereby protecting consumers and producers from unhealthy elements and fraud. Over the past decade, researchers have developed effective and efficient tests to detect lead, formaldehyde, and hydrogen peroxide contaminants. Effective outreach programs have virtually eliminated the likelihood that a commercial Vermont maple syrup product contains these elements. Now, research in progress is examining the efficacy and detectability of decolorizing ion exchange resins. Artificial decolorizing of maple syrup is considered adulteration. It is suspected that ion exchange resins developed for the cane sugar industry are being used to decolorize maple syrup, thus increasing the value of the product. Several methods to detect artificial decolorizing are being evaluated, with the hope that one or more procedures will be helpful in determining when decolorizing has occurred. This research is aimed at ensuring that purchasers of bulk maple syrup are provided the tools to detect adulteration at the producer level, and consumers enjoy contaminant free maple products. In addition, the economics of maple production is preserved by the detection of illegal manipulation of maple syrup color.

Funding: Hatch Act Funds

Scope of Impact: Statewide

MAKING MEATS SAFE TO EAT – The USDA-HHS Draft Listeria Risk Assessment (2001) identified frankfurters, deli meats, smoked seafood, and preserved fish as foods at high risk for transmission of listeriosis. Research completed in 2003 showed that *Listeria monocytogenes* populations can be completely restored in nitrite-injured frankfurters using a Listeria Repair Broth (LRB) unless injury exceeded 99%. Researchers are now working to determine if *Listeria monocytogenes* detection in other nitrite containing products (smoked ham, luncheon meats, smoked seafood) increases through use of repair enrichment strategies using LRB, whether nitrite injury occurs during refrigerated storage of Listeria in other nitrite containing foods, and whether routine use of repair recovery procedures improves Listeria recovery. As part of this project, the use of flow cytometric (FCM) analysis was assessed as a tool for identifying dead, viable, and injured *L. monocytogenes* resulting from heat, acid, or sodium nitrite exposure. Results revealed that different forms of injury affected different molecular sites within Listeria, and that use of FCM analysis with molecular probes and differential dyes affords a powerful and sensitive tool for assessment of relative injury and physiological heterogeneity of Listeria populations. Final results can be used to develop easy, effective ways to insure the safety of foods at high risk for transmission of listeriosis.

Funding: Hatch Act Funds

Scope of Impact: Statewide

IN WITH MORE NUTRIENTS AND TASTE; OUT WITH BACTERIA – Outbreaks of foodborne illness associated with apple cider and dairy products have prompted research on the survival of *Escherichia coli 0157:H7* and *Listeria monocytogenes* in these food systems, respectively. Current processing methods utilize heat for bacterial inactivation, and although effective, these applications may cause undesirable changes in the nutritional and sensorial properties of foods. Non-thermal processing technologies are emerging as promising alternatives. Ultrasound induced cavitation is lethal to many bacteria, especially when combined with other microbial reduction strategies such as heat. A 400W ultrasound generator was used to evaluate the effects of batch and continuous flow ultrasonic treatments on the natural flora and Listeria monocytogenes in milk as well *as E. coli 0157:H7* in apple cider. Continuous flow ultrasound treatment, when combined with mild heat (57C), for 18 minutes resulted in a 99.999% reduction of *L. monocytogenes* and total bacteria in raw milk, and a 99.999% reduction in *E. coli 0157:*H7 in pasteurized apple cider. Aerobic plate count levels of bacteria found in raw milk on ice resulted in similar reductions to that of the pathogen with six minutes of ultrasonic treatment. Microstructural analysis revealed reduction of fat globule size as well as protein lipid interactions, inferring that a potential for improved taste and nutrient content using this method may exist.

Funding: Hatch Act Funds

Scope of Impact: Statewide

KEY THEME: FOOD ACCESSIBILITY AND AFFORDABILITY

INTERNET SUPPORT FOR FOOD STAMP-ELIGIBLE FAMILES – Campaign to End Childhood Hunger (VTCECH) and UVM Extension contracted with a design firm to develop a website (VermontFoodHelp.com) aimed at effectively informing underserved audiences about how the Food Stamp Program works, who is eligible, how to apply to receive benefits, and the economic and

nutritional advantages of participation. After pilot testing and launching the program, 95 trainings were conducted for 425 personnel in agencies working with low-income audiences, including employees of Community Action Agencies, Headstart centers, homeless shelters, employment offices, senior centers, domestic violence organizations, immigrant organizations, parent-child centers, and adult literacy organizations. A year's worth of data was then collected, via the web, to determine how the website could improve to best address underserved audiences and perceived barriers to Food Stamp program participation. A year after its launch, 33,260 visitors logged on to the site, and the food stamp eligibility screening tool was used 5,360 times, with 3,680 stating on the web that they were interested in determining eligibility for themselves or for a client. Of the 2,828 households who answered all pertinent screening questions to address eligibility questions, 73% showed immediate eligibility for Food Stamp program participation, and another 20% were encouraged to apply to obtain more limited benefits from the program. Since its launch, 1,005 people have requested applications through the web. Of the 919 people (representing 2218 household members) who reported to the Food Stamp program that they applied after visiting the web, 82% were eligible and enrolled, a higher percentage than prior to the launching of the web tool. Of the 166 people who were denied enrollment, 81% were ineligible because their income was too high. Families and individuals in two communities targeted for web use applied for and were granted enrollment at higher rates than people in other communities were. Reasons for higher rates are not clear, as these communities may have had higher poverty rates and/or more interested consumers than other communities. Additional work will help to clarify reasons for success in these communities.

Funding: Smith-Lever

Scope of Impact: Statewide

SENIOR FARM SHARE – Seven-hundred-and-fifty older adults or adults with disabilities participated in the Senior Farm Share program this year. Survey results indicate that more than half were returning clients. All participants live in one of 28 subsidized housing sites around the state and qualify as having limited resources. Program participants received a distribution of fresh produce from participating farms each week from June through October. UVM Extension administered distribution, provided education at the housing sites, wrote and distributed a newsletter, and evaluated the program. Survey results from 322 participants indicate that participants significantly increased their sense of security about access and affordability of foods to make up a high quality diet, and increased participation in available food programs to assist people who lack food security. Thirty-three% of participants froze or canned food for later use.

Funding: Smith-Lever

Scope of Impact: Statewide

EXPANDED FOOD AND NUTRITION EDUCATION PROGRAM (EFNEP) – Data from cost benefit studies in Virginia and Iowa show that for every dollar spent on EFNEP, over $10 was saved in health care costs. A 1998 cost benefit study in Tennessee showed that for every dollar spent on EFNEP, $2.48 was saved on food expenditures. In 2004, EFNEP utilized 100 adult volunteers to reach 220 adults and 463 youth. Eighty-nine percent of participants were enrolled in one or more food assistance programs. Adult females were served for 96% of families. Adult education occurred

in groups (61%), individually(23%), and a combination of group and individual (16%) settings. Seventy-two percent of participants completed the program, with an average time to completion of 3.9 months.

- 84% of participants showed improvement in one or more food resource management practices;
- 90% of participants showed improvement in one or more nutrition practices;
- 56% of participants showed improvement in one or more food safety practices;
- The percent of participants demonstrating acceptable practices in all three of these areas jumped from six percent upon entry to 37% upon exiting the program; and
- 32% of respondents stated that they ran out of food during the month less often as a result of completing the program.

Funding: Smith-Lever

Scope of Impact: Statewide

NATIONAL GOAL AREA 3: A HEALTHY, WELL-NOURISHED POPULATION

Currently 53% of adult Vermonters, or 226,615 adults are overweight. The percentage of obese adults in Vermont has increased 71% since 1990. Obesity related disorders now exceed the cost of alcohol and tobacco related diseases combined. National data shows obesity inequitably affects people in different gender, income, and education classes. Success at maintaining weight loss has not improved over this time. VT-AES research has developed a successful means of using the internet to maintain weight once it is lost.

UVM Extension and VT-AES applied 8.8 FTE's toward outreach efforts to increase Vermonter's health and nutrition. During FY 2004 Extension and VT-AES personnel initiated or continued seven research projects and conducted ten outreach programs yielding a total of 10,084 contacts. Programming effort toward National Goal Area 3 reached 2,755 youth. During FY 2004, VT-AES and UVM Extension directed $1,070,683 toward conducting outreach programs to improve Vermonter's health and nutrition. Throughout Vermont there are now efforts to improve school lunches by connecting school staff and students more closely with local agriculture and agricultural products, some of this work occurring through UVM Extension and VT-AES efforts. From establishing and maintaining student gardens, and incorporating agricultural and health concepts into curricula, to increasing formal links between growers and school cafeterias, health-oriented policy changes are being implemented locally. Increasingly, decision making indicates observed connections between health issues and community development, agricultural sustainability, and environmental health.

Nationwide, childhood obesity rates have increased from eleven to 15% during the past decade. Some behaviors contributing to current obesity rates and less healthy youth are diet related. Healthy Vermonter 2010 goals include trying to increase the percentage of teenagers who eat at least two servings of fruit and three servings of vegetables daily. UVM Extension has developed outreach programs reaching more than 2500 youth annually to improve dietary choices and to increase the proportion of non-processed food consumed. VT-AES studies have showed several important links between dairy consumption and health in children. This work, along with other research, is changing how institutions view drinks offered to youth at meals and in vending machines. This research has been transferred to outreach and technology programs and new milk-based products appealing to youth are being developed and tested.

A recent evaluation of the elderly Nutrition Program of the Older Americans Act showed that 67 to 88% of participants were at moderate to high nutritional risk. Four of the five Vermont Area Agencies on Aging do not have qualified nutrition professionals for providing necessary nutrition education. UVM Extension has responded to the request for assistance by offering programs targeting the elderly that reached more than 200 Vermont seniors in FY 2004, and by offering a newsletter for seniors, Words to the Wise, with a circulation of over 3,500. Introducing educational programs, as well as computerized and mailed information resources to homebound elders showed marked improvements in food resource management practices, food safety practices, and key nutrient intakes.

In Vermont, an estimated 7.7% of households lacked access to nutritious, safe, acceptable, and affordable food supplies between 1996 and 1998. For this reason, the new Healthy Vermonters 2010 report includes the objective to "increase food security to reduce hunger" statewide. In stark contrast

to this lack of food security for so many Vermonters is an agricultural state that prides itself on production of a wide range of healthful and tasty products that are enjoyed by millions of people across the country. Two programs in particular aim to improve food security through outreach. The Senior Farm Share program increased confidence of consumers living in subsidized housing about their own food security by 56%, while also assisting communities to support one another, and improving nutrition-related behaviors. EFNEP supported programs also increased confidence and behaviors leading to increased food security and quality diets for low-income adults and children. Each year UVM outreach programs provide more than 1,000 pounds of additional produce for local food shelves. Over the past decade, program participants have donated more than 25 tons of fresh, local produce to food providers for income-limited families. This food has reached homes of more than 7,500 children under five years of age.

KEY THEME: HUMAN HEALTH

IMPROVING VERMONTER HEALTH – UVM Extension health improvement outreach programs reaches more than 2,700 Vermonters each year, leading to improved food purchasing, food preparation, food consumption, and healthy activity-related knowledge, skills, and behaviors. Program results showed significant increases in food security and healthy food purchasing and consumption choices for young and elderly participants challenged with food security issues. Garden-based programs for youth led to improvements in participant vegetable and fruit consumption. Technology-augmented outreach for limited-mobility and at-risk seniors has resulted in improved participant vegetable and fruit consumption; improved mean nutrient intakes of protein, iron, calcium, vitamin C, and vitamin B-6; and knowledge and beliefs about appropriate calcium consumption for the prevention of osteoporosis. Efforts working with diabetic and others at risk of diabetes showed participants improved knowledge, skills, confidence, and longer-term behaviors related to food preparation aimed at diabetes prevention and abatement. New programs working with individuals and families have assisted Vermonters in increasing activity and monitoring progress toward health indicators. Program impacts include the following:

1) *Step into Health*, in its first year, workshops reached 50 participants, ranging in age from 24 to 66, providing tools, advice, and encouragement to increase physical activity for non-active adults, showed

- 42% increase in average number of days per week participants walked (from an average of 3.1 to 4.4 days per week); and
- 61% increase in average number of steps taken by participants on walking days (from an average of 3,735 to 6,025 steps).

2) *Making Nutrition Compute*, in its seventh year, has reached 420 low-income adults in their homes with the aid of interactive computer software designed to improve nutritional habits. This year's 60 participants include:

- 95% increase in number of participants eating the number of recommended servings from one or more of the five food groups;
- 70% increase in the number of participants eating recommended servings from each of the food groups;
- three times as many participants consuming the Recommended Dietary Allowance (RDA) for protein at program end compared to program entry; and

- reducing by half the number of participants consuming less than the RDA for iron and most other vitamins and minerals measured.

3) *4-H Growing Connections* is a garden-enhanced nutrition education program for youth that includes lessons on planning and planting a garden, developing nutrition and cooking skills, building food security and hunger awareness, and enhancing food safety and preservation skills. During the summer of 2004, 1310 children participated in the 4-H Growing Connections program, 79% coming from low-income households. This represents a nearly two-fold increase over 2003 participants, aided by 156 volunteers and 7 UVM Extension staff members. The program was offered in camps, after school programs, free summer lunch sites, low-income housing areas, 4-H clubs, school summer programs, and other neighborhood and community organizations. Adults who completed observations of these 272 youth provided the following information:

- More than 80% of the youth demonstrated proper handwashing for reducing the risk of foodborne illness and kept surfaces clean when preparing, cooking, or serving food;
- 56% of youth set and monitored the goal of eating 5 servings of fruits and vegetables a day, with most achieving this goal;
- 94% of youth participants prepared at least one dish with fresh produce;
- 42% of youth participants donated garden produce and/or canned goods to a local food shelf, an emergency food site, or a neighbor in need of food, totaling 320 pounds of fresh produce;
- 90% of youth participants grew vegetables in a container garden and/ or in a youth garden; and
- 33% of youth participants demonstrated an increased skill in proper techniques for food preservation.

Quotes from student participants include:

- "Food security is having good food that is fresh, like broccoli, carrots, tomatoes, kale, cucumbers, and squash and sharing it with people that need it." (Girl, Age 14);
- "My mom and sister thought I was crazy for eating healthy snacks…until they tried it" (Boy Age 11);
- "Peas are beyond good!" (Boy, Age 10)

Quotes from teachers include:

- "Children would often point out at snack or lunchtime what was healthy and what was not. I noticed snacks were becoming healthier towards the end of summer;
- "Working in the garden really became an exercise in cooperation for this group. They had a variety of tools but of course they all usually wanted a certain one or two. By the end of the summer, they were really trading and working together – especially when harvesting;" and
- "My students were excited about the opportunity to 'give' to the food shelf. For our first year, we were successful in working together to grow vegetables and donate them to people in need."

Funding: Smith-Lever

Scope of Impact: Statewide

INTERNET-SUPPORTED WEIGHT LOSS – UVM is addressing national obesity concerns by providing treatment programs to more than 1,000 Vermonters, and demonstrating the effectiveness of the Internet as a delivery intervention promoting weight loss. A pilot online program, VTrim, helped participants lose an average of 21 pounds in six months – more than two times the weight loss occurring for those using a commercial weight loss website.

Funding: Hatch Act funds

Scope of Impact: Statewide

A NOVEL APPROACH FOR DELIVERING NUTRITION, FOOD SAFETY AND HEALTH INFORMATION TO VERMONT'S ELDERLY – Information technology and the Internet have the potential to deliver health and nutrition information tailored to the users particular needs and provided in a user-friendly, multimedia, and interactive format. In addition, the Internet can provide this information to a large group of people who may be geographically isolated or have other limitations to their mobility. In order to make the most effective use of these technologies, it is essential to understand which components of the technology are most effective. The objective of this 12-month study was to evaluate the effectiveness of an online nutrition and health education program at improving dietary practices and computer attitudes among older adults. Subjects were assigned to an experimental group (receiving the online nutrition and health program; n=16) or a control group (no access to the computer program; n=25). Two touch-screen, Internet-connected computers were placed in each of two congregate meal sites. The experimental site was given access to our online multimedia nutrition and health education program built around components of the Health Belief Model (HBM). All subjects completed a nutritional risks survey (Nutrition Screening Initiative), food behavior checklist, and computer attitude survey at baseline, 3 months, and 12 months. For qualitative evaluation, focus groups were conducted between eight and ninth months after program initiation. Between group and within group over-time differences were statistically analyzed by Chi-square analyses and repeated measures ANOVA. The results of this study clearly indicate that the Web application was successful at helping get seniors connected to the Internet and to the wide assortment of health resources on the Internet. Based on our focus group studies, we also know that the nutrition, food safety, and health web application had a strong positive impact on the nutrition and health behaviors of study participants.

Funding: Hatch Act Funds and Smith-Lever Funds

Scope of Impact: Statewide

NATIONAL GOAL AREA 4: GREATER HARMONY BETWEEN AGRICULTURE AND THE ENVIRONMENT

UVM Extension and VT-AES focused 7.2 FTEs toward addressing these issues this past year, and $1,270,887 in federal and state funding. Efforts yielded 11,345 contacts, 2,099 of which were with youth. Efforts included the work of 102 volunteers who worked 430 volunteer hours. Three themes dominated FY 2004 effort under National Goal Area 4 for UVM Extension and VT-AES –

- Using research and outreach to improve farm and home water quality related behavioral changes;
- Developing community-wide understanding of the links between natural resources and sustained community development; and
- Reducing the negative impacts of traditional pest management strategies by research and education about improved strategies.

Storm water runoff is contaminating streams, rivers, ponds, and lakes causing summer beach closures that threaten the quality of life and tourism development, and affecting development plans around the state until water quality standards can be met. High nutrient inputs on farmlands, businesses and residential properties, residential waste treatment practices, and failed or failing septic systems, particularly along shorelines, have resulted in increased water pollution. Excess phosphorus is a primary cause of impaired water quality in Lake Champlain. Dairy farms are considered a large source of phosphorus.

A strong link between research and outreach has helped to reduce the impact farmers have on phosphorus runoff into streams and lakes. UVM has produced new models that help farmers to sustain farm profitability while decreasing phosphorus loads in waterways by evaluating farm-level financial costs and environmental benefits associated with implementing alternative farm practices to achieve phosphorus reductions. Research on soil factors influencing phosphorus availability to plants and concentrations in runoff, comparisons of low-phosphorus and conventional feeds, and the development of an index and easy-to-use device to determine the likely concentrations of phosphorus runoff from farms have provided useful information and tools for outreach. Outreach is focusing on increasing the number of farmers applying computer software designed to incorporate low-phosphorus strategies with other management strategies to maintain or increase profits while reducing phosphorus runoff. In the past five years, more than 500 agency and farm personnel have been trained in using these software packages, with 60% implementing them in their work.

UVM Extension also provides demonstrations for residential neighborhood groups and commercial property owners on low-input lawn care, gardening, and waste elimination. Efforts in three communities have led to changes in residential and business water use and waste practices, youth water quality monitoring and community presentations to show the status of waterways, and changes in nutrient runoff for farmers. Efforts resulted in 84 families adopting water conservation practices and low-input gardening practices, and 350 commercial users and school groundskeepers reduced use of pesticides after attending educational programs.

The development of new products and new production methods that are environmentally benign will provide economic opportunities yet protect the environment. This project is comprised of three separate efforts that will produce new products and production methods that impact the environment.

- Project 1) Researchers are developing products from whey that replace petroleum based products. Researchers are engaged in scale up production and efficacy studies for a whey-based wood finish. Researchers have also prepared several formulations of a whey-based delivery system to encapsulate biocontrol agents for pest control in forests and greenhouse environments.
- Project 2) Researchers are testing environmentally benign methods to remove phosphorus (P) from dairy wastewater and prevent eutrophication of surface waters. Researchers have inserted phosphorus filters into the wetlands system and are monitoring effectiveness of their performance in removing P from the effluent stream.
- Project 3) Researchers are trying to determine the cause of off-flavors in maple syrup production that, in some seasons, affects millions of gallons of syrup. Researchers are characterizing the amino acid and phenol components that influence the development of the metabolism of off-flavors in maple syrup.

Whey-based wood finish and biocontrol delivery systems will reduce reliance on petroleum-based products. Implementation of phosphorus filters will diminish or prevent algal blooms and depletion of dissolved oxygen that affects water quality in the Lake Champlain region. Characterization of the amino acid and phenol components that influence the development of the metabolism of off-flavors in maple syrup may provide insight to where and when the metabolism of off flavors might occur and allow for the development of a method or strategy to eliminate or reduce the problem**.**

Whether decisions are being made about public land surrounding communities, or about ecotourism development, UVM Extension works with a diverse set of stakeholders having a history of confrontation and conflict to improve understanding and communication. Outcomes indicate that our public issues education programs, developed by bringing diverse sets of stakeholders to the table for education and interest-oriented discussions increases trust and improves collaborative decision-making, saving individuals, interest-based organizations and agencies money that would otherwise be spent communicating through legal channels. As a result of attending UVM Extension educational workshops 31 forest landowners started or expanded a recreational enterprise, increasing the value to owners of maintaining forested lands.

Improving methods for agricultural and home pest management is another area being addressed by VT-AES and UVM Extension. VT-AES has developed new methods to quantify ecological impacts of biological control programs. VT-AES and UVM Extension have reduced pesticide use by farmers and home gardeners while increasing profits for industries vulnerable to pest infestations, such as apples and greenhouse growers. The following section summarizes highlighted outcomes directed toward developing greater harmony between agriculture and the environment.

KEY THEME: WATER QUALITY

NUTRIENT MANAGEMENT RECORDKEEPING – Farmers enrolled in USDA programs for environmental enhancement of their farms often have difficulty keeping accurate crop records. Through a partnership with University of Pennsylvania, CropMD is technically current software available to farmers and consultants for keeping accurate crop records and developing nutrient management plans for their farms.

- 37 farmers who were introduced to CropMD in 2004 report that the program is very useful to them in managing farm crop records and for providing annual compliance reports to USDA and the State of Vermont Agency of Agriculture.
- 25 of these farmers have used the software to develop whole-farm nutrient management plans for their farmland.
- Based on a survey sample, 85% of 650 clients reported they used information on nutrient management to improve compliance with regulations and improve water quality.

Funding: Smith-Lever

Scope of Impact: Multistate

HELPING COMMUNITIES TO TARGET WATER QUALITY IMPROVEMENT EFFORTS – UVM Extension is working with four communities by forming local collaboratives to design and implement locale-specific water quality education and protection strategic initiatives. Local community organizations, local high schools, and local officials have formed partnerships to inform and educate watershed residents about water quality protection. By working with groups to determine site-specific priorities for improving water quality, communities can better identify and focus efforts to magnify success. For example:

- Businesses, neighbors, and schools have worked together to change lawn, garden, and home improvement practices resulting in less polluted waters reaching a neighboring "orphan" brook that leads to Lake Champlain.
- One year after a neighborhood organization formed, 480 of 500 households bordering the brook have implemented low-input gardening practices.
- Another city group successfully applied for a grant to conduct a survey that will be used to develop targeted neighborhood water quality education efforts.

Funding: Smith-Lever

Scope of Impact: Statewide

WATER QUALITY EDUCATION FOR YOUTH – Vermont schools historically lack support for science-based watershed and water quality education. Community groups have noted that UVM Extension offers water quality education support for Vermont youth. The UVM Extension-sponsored Watershed Alliance (UVM-WSA) has assisted teachers and students learning about watersheds and water quality through a program utilizing interactive models, field-based water sampling, and expert-assisted water analysis that meets science-based education standards and encourages place-based learning and outreach for participating schools. This year:

- Students from around the state participated in 42 sessions covering 35 streams and waterways within nine watersheds of Vermont, with the help of 27 UVM interns.
- An average of 85% of all students reported increasing knowledge and skills on watershed and water quality topics.
- Students made 13 presentations about water quality in local waterways to their communities.
- Monitoring information has been made available to the public through an on-line database.
- An on-line tracking system that can be used by all volunteer water-quality monitors in Vermont is being developed by a participating school district.

- The Watershed Alliance partnered with the Vermont Institute of Natural Science to offer a summer watershed professional development institute for teachers. All of the 21 participants intend to integrate new knowledge, skills, and abilities gained into their 2004-2005 curricula. The workshop complies with state educational recertification standards, such that all participants received recertification credits, and seven additionally received graduate Continuing Education credits.
- UVM-WSA tailored curriculum to match needs for students participating through the SUCCESS school, an alternative middle and high school located in Rutland serving at-risk youth with severe emotional and behavioral disabilities. While students were initially reluctant to participate, they later became active and interested learners, and are now preparing to present results of their study of a brook listed on the state's impaired waters list to a local watershed council formed by local policy makers, experts, and concerned citizens. Educators were impressed and plan to include the Watershed Alliance program in future SUCCESS school science classes.

Funding: Smith-Lever

Scope of Impact: Statewide

FAMILY-BASED WATER CONSERVATION GARDENING PROGRAM – Over the past 29 years, the Rotary Club and UVM Extension has helped 1900 families to improve gardening skills, while changing garden practices to conserve water and reduce stream and lake pollution. During 2004:

- 84 families, with 43 attending for the first time, and 115 youth participated in the program with the help of 50 volunteers.
- All participants reported they increased awareness about water conservation issues related to gardening.
- The average attending family planned to implement eight of ten skills learned during the current gardening season.
- End-of season surveys showed 78% of participants making at least one change that improves water conservation and water quality over the past.
- 82% of participating families improved soil preparation using compost and other non-chemical products.
- 67% of families improved planting methods by planting in furrows.
- 80% of families used mulch in and around the garden.
- 88% of families improved watering patterns to conserve water use.
- All participating families reduced or eliminated use of chemical pesticides when managing for insect pests.
- Gardeners also contributed 125 pounds of produce to local food shelves.

Funding: Smith-Lever

Scope of Impact: Statewide

REDUCING UREA IN DAIRY CATTLE – Optigen 1200 is a slow-release polymer-coated urea product developed by CPG Nutrients. Preliminary data on the product suggested that inclusion of the

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product in dairy rations not only increased milk production, but also lowered rumen ammonia concentrations and blood urea concentrations. Thus, the product has the potential to reduce nitrogen excretion in the urine. Consequently, the product had two pluses for it from a dairy producer's viewpoint: increasing milk production and reducing the environmental impact of dairy manure. Researchers conducted feeding experiments to test these hypotheses. Researchers found that the potential to reduce rumen ammonia concentrations was highly dependent on other dietary components. Polymer-coated urea was not effective at reducing nitrogen excretion by dairy cattle. This research will assist 1300 Vermont dairy producers in making informed decisions about feed purchases.

Funding: Hatch Act Funds

Scope of Impact: Statewide

REDUCING PHOSPHORUS RUNOFF FROM FARMLAND – Degradation of surface water quality by phosphorus-induced eutrophication is a major problem in Vermont. Researchers carried out a series of rainfall simulator experiments, covering a range of soil types, crops, and soil test phosphorus levels, in both fields and test pans in order to better understand soil characteristics affecting phosphorus runoff levels. Results showed a strong linear relationship between dissolved runoff phosphorus and soil test phosphorus. Results from field and pan experiments were similar. However, suspended solids were 2 to 10 times greater from the pans than from field plots, making it difficult to estimate likely total P loss in the field from runoff pan experiments. In a comparative study on 23 soils from the Champlain Valley of Vermont and New York, phosphate mono- and di-esters leached through soil more readily than inorganic orthophosphate soluble phosphorus. Results of these experiments were incorporated into a revised Vermont Phosphorus Index. By identifying those fields most at risk for phosphorus loss, the P-Index is helping planners and farmers focus their phosphorus management efforts where they will do the most good in reducing runoff phosphorus transport to lakes and streams.

Funding: Hatch Act Funds and Smith-Lever Funds

Scope of Impact: Statewide

MULTI-SCALE MEASUREMENT OF PHOSPHORUS LOSS IN SURFACE RUNOFF FROM MANURED FIELDS – During the year, a number of potential sites were explored for phosphorus-runoff studies (a paired-watershed experiment and a large-plot study of manure management and cover crop alternatives). Several sites that seemed suitable initially were subsequently rejected, while a few are still under consideration. Researchers expect one or more sites to be finalized and initial fieldwork to begin by the end of the year. In related studies, researchers carried out rainfall simulator experiments at 12 locations on 3 fields on two farms, representing a range of soils, crops, and manure management. Runoff was collected for 30-minute periods on two consecutive days at each location. In comparing runoff from hay plots with and without recently applied manure, dissolved phosphorus concentration in runoff from plots in the manured part of a hayfield was four to ten times greater than that from non-manured areas on the first day. On the second day, phosphorus concentration in runoff from non-manured plots was similar to or slightly less than that on Day 1, while concentrations from the manured plots had declined to one-half or one-third of their Day 1 values. This shows that the effect of surface-applied manure declined more rapidly from Day

1 to Day 2 than the effect of soil test phosphorus. With this information, researchers expect to be able to give better nutrient management recommendations to farmers that will lead to decreased phosphorus pollution in streams and lakes.

Funding: Hatch Act Funds

Scope of Impact: Statewide

DEVELOPMENT OF AN AGRICULTURALLY-ORIENTED PHOSPHORUS INDEX – Researchers have completed development of a revised Phosphorus (P) Index for Vermont, including: establishing a multi-agency work group to review and provide feedback (met 5 times in 2003); reviewing existing P-Indexes from other states (nine states in the Northeast, Southeast, and Midwest); reviewing and analyzing recent and ongoing research from VT and other states; establishing a database of about 200 actual fields with data for running the P-Index; and evaluating two P-Index approaches and choosing a semi-quantitative "pathway". Because an intermediate step in the P-Index calculation involves estimating dissolved and particulate runoff P, researchers were able to evaluate successive versions of the P-Index by comparing to results of paired watershed research studies. To evaluate practical use of the P-Index researchers distributed a draft version (as an Excel spreadsheet) to crop consultants and NRCS and Extension field staff in the summer of 2003 and used the feedback to make further revisions. Researchers completed a 2004 version of the P-Index and trained 32 nutrient management planners (crop consultants, industry, USDA and state agency staff) in two workshops that combined lecture/discussion, hands-on computer work, and field visits. During the 2004 growing season researchers carried out an in-field research phase of the project by establishing a series of rain simulation plots on several fields across a range of soils and crops. Results of a partial P-Index from these and other field sites are being compared to actual measured P runoff concentrations and amounts. Results of this field research, along with feedback from users, will be used to develop further revisions of the P-Index if warranted. The revised research-based P-Index is a useful tool for nutrient management planners, allowing farmers the flexibility to adjust management practices to meet environmental and economic goals. Researchers have trained planners in use of the new P-Index so they will be able to effectively incorporate P-Index ratings into the nutrient management planning process.

Funding: Hatch Act Funds

Scope of Impact: Statewide

INTERACTIVE SPATIALLY DYNAMIC FRAMEWORK FOR SUSTAINABLE WATERSHED PHOSPHORUS MANAGEMENT – This project is investigating the feasibility and utility of integrating mass-balance phosphorus (P) simulation modeling, a P-Index, and variable source area hydrology into a framework to assess the long-term risk of excessive P export across a variable landscape. Researchers expect the results of this project to provide guidance on the development of regional programs designed to reduce phosphorus deposits in Lake Champlain. Existing watershed dynamic simulation models for agricultural, urban, and forested land have been combined to track P inputs, outputs, and accumulation for individual (900 m2) pixels. The 'Pixel P-balance Model' tracks manure, fertilizer, and other P inputs, P outputs in harvested crops, accumulation of soil P, and runoff losses of particulate and dissolved P over decades. The Vermont P-Index has been incorporated to provide an indicator of the likelihood of P loss from each pixel based on landscape

features and management. Runoff contributing areas have been mapped by estimating runoff, combined with identification of probable sources of saturated overland flow. Saturated areas are identified using a 'wetness index' based on a digital elevation model (DEM). Each pixel is assigned a probability of contributing runoff, to be used as a multiplier of modeled P export to yield an index of P export risk. These elements are linked using ArcGIS and the Spatial Modeling Environment (SME) software that facilitates spatially-explicit modeling by linking icon-based models (such as our models constructed in STELLA) across a variable landscape. Using this model, the effects of alternative management strategies, such as nutrient management applied where a certain soil P threshold is exceeded, can be assessed by varying model input arrays. Researchers have developed all model parts and successfully run refined STELLA models in SME. Future work will include refining the model and testing it on a small subwatershed before applying it to the full 18,500 hectare model watershed. Researchers will also develop output display graphics to allow users to visualize the impact of current or future management policies on watershed P dynamics. Researchers will develop alternative management scenarios to apply the framework to watershed management for reduction of long-term risk of P loss. Throughout the process, the project investigators will continue to work with an advisory committee that includes representatives from state and federal agencies, agricultural professionals, conservation groups, and land use planners. Linking GIS and watershed models will provide policymakers estimates of P losses from different regions and land use in the watershed.

Funding: Hatch Act Funds

Scope of Impact: Statewide

CONSTRUCTED WETLANDS AS AGRICULTURAL RUNOFF TREATMENT METHOD – This innovative project is testing four different strategies of wetland operation to remove dissolved organic compounds, ammonia and nitrate, and phosphorus from wastewater of the dairy operation. Initial results demonstrate the effectiveness of river bulrush in removing dissolved organics and nitrogen-containing compounds and slag filters in removing dissolved phosphorus. Results from the first nine months of operation showed that biochemical oxygen demand, total suspended solids, and *E.coli* reduction was highly efficient (100%, 85-95% and 85-99%, respectively) in treated cells. Nitrogen removal was less efficient, especially in southern treated areas, with performance improving through aeration, thereby reaching an average of 90.6 % after three weeks. Dissolved phosphorus (P) removal performance was better than that of ammonium. Treated cell phosphorus removal averaged greater than 50%. Plant samples were taken from the wetlands inlets and outlets in order to determine the amount of nutrients taken by the plant biomass, and results confirmed the positive results anticipated from treated cells based on the literature. These efforts represent an effective system that can be implemented by Vermont dairies to help protect the water quality of Lake Champlain.

Funding: Hatch Act Funds

Scope of Impact: Statewide

DEVELOPMENT OF LOW-COST, ENVIRONMENTALLY FRIENDLY SNOW/ ICE MELTING PRODUCTS FROM CHEESEMAKING WASTE PRODUCT – Currently used deicers are causing serious corrosion and major environmental problems. The application of sodium chloride and

calcium chloride deicing salts to roadways has increased dramatically in recent years due to public demand for safer winter driving conditions. Unfortunately, these salts create adverse effects such as corrosion-related damage to the highway infrastructure and environmental damage to water supplies and soils. Meanwhile, biomass wastes such as liquid whey effluents from dairy industry are a burden on the environment due to their high biological oxygen demand. The objective of this project is to utilize lactose from milk permeate, an important byproduct of the cheese industry, as a renewable resource for production of potassium acetate - a non corrosive environmentally friendly road deicer. A combined anaerobic fermentation process was developed to produce potassium acetate from cheese whey permeate. A co-culture consisting of *Lactococcus lactis* and *Clostridium formicoaceticum* was used to convert the whey lactose to lactic acid and then to acetic acid in a bioreactor. The effects of various conditions (pH, ions, ratio of extractant to diluent, and ratio of solvent to broth) on the extraction efficiency were investigated. Appropriate methods have been successfully developed and larger scale production of potassium acetate is underway. Researchers are also in the process of investigating the effects of these prototype deicer products on ice/snow in the laboratory and its on-road performance. The ultimate goal of this research is to develop a low-cost acetate deicer from agricultural byproduct - cheese whey. Successful development and application of such a product will be beneficial to the dairy industry, transportation system, and the environment.

Funding: Hatch Act Funds

Scope of Impact: Statewide

KEY THEME: INTEGRATED PEST MANAGEMENT

INTEGRATED PEST MANAGEMENT FOR GROWERS – Because of outreach efforts in the form of workshops, on-line and telephone consultations, mail-in diagnostic requests, and interactive television presentations, UVM Extension achieved the following results:

- 100% of 125 greenhouse growers intend to adopt at least one IPM practice they learned;
- 95% of 1200 certified pesticide applicators and 100 yet-to-be certified pesticide applicators increased their knowledge of safe and judicious use of pesticides;
- 75% of 300 vegetable and berry grower participants indicated through email survey they have increased their knowledge of IPM strategies;
- 85% of 225 Master Gardeners indicate they gained information on pest identification, management and pesticide impacts on the environment;
- 90% of 200 growers using UVM's Plant Diagnostic service indicate through email surveys that they learned new information that increased their knowledge of pest management, including the ability to identify pests and the lowest-input methods for reducing their negative impacts;
- 95% of 160 private pesticide applicators report they learned at least one new item of information that will help them to reduce the negative environmental impacts of pesticide application;
- 100% of 30 maple syrup producers can now differentiate between the Asian longhorned beetle and the whitespotted sawyer.

Funding: Smith-Lever

Scope of Impact: Statewide

APPLE INTEGRATED PEST MANAGEMENT – Although integrated pest management (IPM) has reduced the use of pesticides, apple production is still dependent on pesticide use. For example, in New England, apple growers annually spray five to seven insecticide applications, eight to ten fungicide applications, one to two miticide applications, and one to two herbicide applications. The Vermont Apple IPM Program is committed to maintaining and increasing IPM implementation in approximately 90 commercial orchards across the state by continuing to deliver an integrated extension and research program that addresses IPM priorities identified by growers, grower consultants, and other industry service providers. Faculty and staff handled more than 300 phone consultations, had over 10,000 hits to a rapidly updated website, and conducted more than ten tours, orchard visits, and workshops. An annual mail survey to 90 Vermont orchardists showed the following results:

- 92% stated they learned how to better use IPM techniques;
- 81% stated they learned new IPM techniques;
- 70% reduced or minimized use of pesticides;
- 78% were able to better determine if pesticides were needed in their orchards; and
- 86% were helped in effectively timing pesticides if they were required to reduce negative environmental and consumer impacts.

Funding: Smith-Lever

Scope of Impact: Statewide

SAFER SCHOOLS THROUGH IPM – School-aged children are more vulnerable to the negative health effects of pesticide than adults due to body size, developmental changes, and behaviors. UVM Extension is trying to encourage the use of IPM strategies on school grounds to reduce student exposure to pesticides. As a result of a workshop targeting 75 school administrators and groundskeepers from 20 schools around the state, 75% of the attending facilities managers and custodians said the information would help them to reduce the use of pesticides in and around school property.

Funding: Smith-Lever

Scope of Impact: Statewide

KEY THEME: INTEGRATED PEST MANAGEMENT

BIOLOGICAL PLANT DISEASE CONTROL – The current approach to controlling plant disease in agricultural settings is through the use of chemicals to interfere with or eliminate plant disease stemming from pathogen infection. An understanding of the mechanisms through which binding of *P. fluorescens*, a common soil bacterium, to the roots of plants confers plant disease resistance will provide an ecologically friendly alternative to current integrated pest management strategies. Researchers first attempted to analyze differences in binding between wild type seedlings and T-DNA insertion lines, but no differences were detected. They therefore decided to take an alternate approach. The binding surface to which *P. fluorescens* attaches is determined by the structure of the root cell wall. Previous work identified two proteins that play a structural role in determining the

architecture of this wall. The researchers are currently generating transgenic arabidopsis lines with constructs that may change cell wall structure and will then test these to determine if they alter binding of *P. florescens* to the growing root.

Funding: Hatch Act Funds

Scope of Impact: Statewide

MULTIDISCIPLINARY EVALUATION OF A BIOPESTICIDE ALTERNATIVE (KAOLIN) FOR FRUIT GROWERS – Research of a new 'reduced-risk' biopesticide, kaolin is defining its optimal role in mitigating pest management challenges resulting from the implementation of the Food Quality Protection Act (1996). During the past three growing seasons data comparing current IPM methods with kaolin treatment on apple fruit weight, size, skin color, flesh firmness, soluble solids, starch index ratings, russetting, water core, internal breakdown or browning, bitter pit and other harvest disorders as well as overall fruit attractiveness using standard criteria, measurements of tree productivity (flower density, fruit set, and yield efficiency) showed no significant differences. Fruit drop was significantly greater in 2001 for kaolin-treated fruit versus the IPM treatment. Total fruit yield efficiency was significantly greater for the IPM treatment than kaolin treatments in 2002 and 2003. In the two years (2003, 2004) in which the impact of kaolin on predatory mites was monitored, kaolin-treated trees had, overall, significantly fewer predatory mites compared to trees that received the IPM treatment or no treatment, although in 2004 there were significantly higher pest mite populations on kaolin-treated 'McIntosh' trees (an important Vermont apple crop) compared to IPM or non-sprayed trees. In 2004, an overview of the project was presented to the growers and industry representatives and a tour was conducted of the research site. Project data analyses were presented at the December 2004 New England Fruit School, which is the largest conference of the apple industry in the region, and the February 2005 Vermont Tree Fruit Growers Association Annual meeting.

Funding: Hatch Act Funds and Smith-Lever Funds

Scope of Impact: Statewide

NOVEL CULTURE CONTROLS FOR THRIPS IN SPRING BEDDING PLANTS – Bedding plant sales provide critical income for greenhouse growers in northern New England. Western flower thrips is a primary pest of this crop and insecticides are used heavily for their control. Many greenhouses in this region stand empty over the winter; we do not know if thrips survive this fallow period to infest new crops in the spring. Thirteen winter-fallowed greenhouses in 3 plant-hardiness zones in ME, NH and VT were monitored for thrips using yellow sticky cards and emergence traps from Dec. thru' May, in 2002, 2003 and 2004. Thrips were found in nine of these greenhouses in Jan/Feb; eight had gravel/dirt floors; virus was detected in weeds in three locations. Thrips were absent in greenhouses with fabric mats where weeds were removed. IPM workshops were held in January of each project year in each of the 3 states, and growers were updated on our findings and appropriate actions to eliminate overwintering thrips. The workshops have focused on promoting the use of different biological control agents, and the implementation of IPM practices. We have now documented that thrips can survive the winter inside greenhouses in northern New England, though in small numbers, even when no crops are present. Dirt/stone floors appear to enhance thrips survival, combined with the presence of weeds. Use of fabric mats and removal of weeds appear to

be key tools to remove this potential source of infestation and viral infection for incoming spring crops. Results demonstrate the importance of sanitation practices at the end of the growing season. These findings are applicable to >5000 growers in the Tri-state region and many more in 31 states having similar plant-hardiness zones.

Funding: Hatch Act Funds and Smith-Lever Funds

Scope of Impact: Multistate

DEVELOPMENT, EVALUATION AND SAFETY OF TRANSGENIC CROPS AND ENTOMOPATHOGENS FOR CONTROL OF ARTHROPOD PESTS – Integration of biologically-based pest management strategies into crop protection programs is critical to the development of sustainable agricultural production systems. Prior to the widespread implementation of new crop protection technologies, though, their ecological impact should be assessed. In particular, effects of microbial control agents and transgenic crops on important non-target soil organisms, e.g., Collembola, need to be determined. Field trials were initiated in 2002, and replicated in 2003 and 2004, to document effects of Bt silage corn (transgenic plants expressing insecticidal proteins from the bacterium, *Bacillus thuringiensis*) on Collembola and other soil-inhabiting arthropods. In lab mesocosms, Collembola were fed on root powder from Bt-corn or the isogenic line. After 8 weeks, populations were not significantly different. Findings were consistent across root sample dates, although sample date appeared to be weakly significant, suggesting differences in the nutritional quality of the root powder diet. Collembola were also exposed to insect-killing fungi and their metabolites, but were not infected or killed. Field trial data has been collected and analysis is in progress. Results of these studies help to identify potential benefits and risks associated with new crop protection methods. Decisions relevant to the use of transgenic crops and insect pathogens need to be made in light of the alternative management strategies available, particularly chemical insecticides, which generally have a more deleterious and broader ecological impact.

Funding: Hatch Act Funds

Scope of Impact: Statewide

KEY THEME: LAND USE

IMPROVING COMMUNITY-BASED DECISIONS ABOUT RECREATIONAL TOURISM THROUGH PARTICIPATORY MODELING – UVM Extension collaborated with community leaders and volunteers and the Gund Institute for Ecological Economics to design and implement a new model for making regional and community-wide decisions about ways to develop recreational tourism industries. The participatory exercises bring community representatives from a wide variety of stakeholder groups to the table. Through the use of an interactive icon-based software program, STELLA, community members brainstorm to develop community-specific descriptions of the many interacting forces affecting current and desired recreational tourism conditions. Participants use this information to create a model that enables them to ask questions, and visualize the short and long-term social, economic, and environmental impacts of different tourism development scenarios. Tested in three areas (one each in NY, VT, and NH) thus far, initial results show an overwhelming response by nearly all of more than 50 participants that the meeting format and software provide

powerful new knowledge about the various forces creating impacts through tourism development strategies, and useful insights into the diverse perspectives of other participants. Three more communities will try the model this coming year, and further work with this year's participants will offer additional insights into the utility of this model for creating positive change regarding recreational tourism development.

Funding: Smith-Lever

Scope of Impact: Multistate

FACILITATING PUBLIC LAND USE ISSUES EDUCATION – The 25-member Blueberry Hill Group (BHG) was originally created as a discussion group whose interests in the Green Mountain National Forest are diverse. The Green Mountain National Forest lies within six different counties and 44 towns in Vermont. Controversial issues in the Green Mountain National Forest include proposed wilderness designations, timber harvesting, and trail use conflicts. Comprehensive planning for the Green Mountain National Forest was augmented by UVM efforts, led by an Extension faculty member, to find common ground and share information between stakeholders. An issues education forum approach was combined with an assessment of local socio-economic status and demographic trends, forest users and uses, access and travel patterns, community relationships, economic ties, and land use patterns and perceived needs. UVM's Center for Rural Studies provided census and other valuable data that contributed to the discussion of the five year plan. During the last session before taking a break for the summer, the BHG created a summary list of points of agreement. This was a monumental accomplishment for a group characterized by widely divergent perspectives and a history of animosity. One participating group, Conservation Law Foundation, stated that they have been "pulling punches" in keeping with the BHG spirit of working collaboratively. Preliminary survey results show increased communication and improved awareness of diverse perspectives among group members.

Funding: Smith-Lever

Scope of Impact: Statewide

WOODLAND RECREATION AND TOURISM OPERATIONS FOR INDIVIDUALS – Woodland owners are seeking additional ways to generate income to pay taxes and other costs of owning land. UVM Extension personnel held a workshop and published proceedings about Managing Woodlands for Recreational Enterprises. The workshop drew 100 participants from Vermont, four other New England states and New York. Impacts based on evaluation six months after the workshop include:

1) 31% of participants have taken steps to start or expand a recreational enterprise. Examples include:
    - Established a Northern Forest Canoe Trail campsite;
    - Improved recreation potential of clients' land; and
    - Diversified a sheep and beef farm into recreation (renting a house to vacationers)
2) 23% are less likely to start or expand an enterprise. Comments include:
    - "Closed "choose and cut" Christmas tree operation due to liability concerns;"
    - "Realized that I need to step back and hire a professional forester to develop a long-term plan;" and

- "We received enough information from the workshop to tell us the economics weren't there."

3) More workshops are wanted on similar topics:
   - 54% want a workshop about other income opportunities for woodland owners;
   - 15% want a forum to discuss strategies for maintaining access to private lands
   - 15% want an in-depth business planning course.

Funding: Smith-Lever

Scope of Impact: Statewide

KEY THEME: NATURAL RESOURCE MANAGEMENT

MASTER GARDENER INVASIVE SPECIES OUTREACH EDUCATION – The VT Department of Agriculture, Agency of Plant and Industry, has named a group of plants "quarantined" under the designation of Vermont Invasive Exotics. It has been determined that these plants are a threat to native habitats in Vermont and that public awareness is crucial to effectively reduce the use of these plants for ornamental landscaping. The Master Gardener program is providing education outreach to the Vermont public regarding this environmental issue. In collaboration with The Nature Conservancy, Master Gardener members have been trained to provide workshops and public awareness outreach at events statewide. Master Gardener members worked in eight counties with 268 consumers through visits to civic groups, with 206 people through phone and email consultations, and with more than 200 people at county fairs and flower shows, providing information on invasive exotics. Volunteers also hand-eradicated invasive species from wetlands and roadways in 14 communities, contributed 226 hours to growing invasive replacement species in nurseries, and maintained educational information about exotic invasive species on the VT Master Gardener website. In all, Vermont Master Gardeners contributed over 400 hours in education outreach toward this issue.

Funding: Smith-Lever

Scope of Impact: Statewide

KEY THEME: FOREST RESOURCE MANAGEMENT

DEVELOPING SUSTAINABLE STRATEGIES FOR LAND USE IN THE NORTHERN FOREST – The four "northern forest" states (Maine, New Hampshire, Vermont and New York) have developed a report on state property tax legislation in the four states and all cost-sharing programs between the federal and state governments related to sustainable forestry. A survey of Vermont foresters compares costs and benefits of planning forest management solely for timber versus for additional goals. Researchers developed a draft survey to investigate the motivations and roadblocks of forest landowners to enroll in forest certification programs. Researchers have also created a framework for multi-criteria decision analysis that will guide ecological economic comparison of management regimes using PROMETHEE software. To this end, researchers have developed a list of criteria to be used (pulled primarily from the "Benchmark Parameters of Sustainability for VT Forest Resources"); the alternatives to be considered (i.e. status quo definition, new "optimal" use definition, a projection of current trends.); and a strategy for effectively determining the criteria

preference weights for the respondents of the modified Delphi survey. Finally, our project partner, Vermont Family Forests, has selected a plot of land in the Stockton area and is preparing and costing out a conventional management plan as well as a management plan using the principles of sustainable forestry management. Researchers will use these two plans as key inputs into the multi-criteria evaluation. A Northeastern Scientific Research Cooperative grant for $100,000 that is complementary to the Hatch project has permitted goal expansion and a one-year timeline extension. The project will lead to an improved understanding of how the northern forest should be managed in order to maximize its ecological, economic, and social contribution to the welfare of the area's citizens in a sustainable fashion. It will clarify the reasons many landowners do not manage their forests in this fashion, and propose policy alternatives that would lead to more sustainable, just and efficient management of the region's forests.

Funding: Hatch Act Funds

Scope of Impact: Multistate

NITROGEN MOVEMENT THROUGH FORESTED ECOSYSTEMS – Excessive nitrogen deposition has been shown to have negative effects on forest health. Little is understood about how deposited nitrogen moves through forest ecosystems to affect soil health. Soil nitrification rates and nitrate concentrations in stream water vary considerably across northeastern USA sites that receive similar levels of atmosphere N deposition. UVM researchers measured soil net nitrification rates and stream nitrate export in ten watersheds in Vermont, New Hampshire, and New York. These sites included adjacent watersheds with differing amounts and patterns of nitrate export. The objectives were to (a) determine the relationship between nitrification rates and watershed characteristics (e.g. vegetation, soils, topography), and (b) to explore the link between these rates and watershed nitrate export. Net nitrification rates were highly variable both within and among the ten sites but average watershed rates were correlated with stream nitrate export. Within some sites, rates were related to the soil C/N ratio and vegetation characteristics (abundance of sugar maple or conifers). Using watershed averages, these parameters were good predictors of both average net nitrification rates and stream export. The impact of increased N deposition is difficult to discern, however, within the background of soil and vegetation processes. Further analysis should yield results that provide a predictive tool for estimating the impact of continued nitrogen deposition on different watersheds.

Funding: Hatch Act Funds

Scope of Impact: Multistate

KEY THEME: HAZARDOUS MATERIALS

GENETIC AND PHYSIOLOGICAL CHARACTERIZATION OF A NOVEL IRON-REGULATED BACTERIAL POLLUTANT DEGRADATION ACTIVITY – Development of bioremediation strategies requires a comprehensive understanding of not only how microorganisms transform pollutants, but also of microbial ecology and biogeochemical interactions. Chlorinated solvents in groundwater, and their anaerobic degradation daughter products, continue to pose a significant technical and costly challenge to bioremediation efforts. Knowing the physiological function of dechlorinating molecules is an important step in designing ways to maximize its production at contaminated sites. Information regarding production regulation of one of these

dechlorinating molecules (Pyridine-2,6-dithiocarboxylic acid, or PDTC) will likewise enable engineering of site conditions, and use of organisms that are inherently more efficient for this purpose. Studies aimed at determining the physiological function of PDTC, showed that it is a siderophore (microbial iron-chelator, or "iron-bearer") whose production is regulated in response to its own concentration and that of other siderophores. A whole-genome mutagenesis approach applied to an iron-chelating organism (*Pseudonomas putida*) identified genes necessary for wild type PDTC biosynthesis. Those data implicated genes of sulfur assimilatory metabolism, and transcriptional and post-translational regulatory proteins as elements of PDTC production and control. Further details regarding regulation and utilization of PDTC are underway. Those will allow rational design of conditions and strains for maximal dechlorinating molecule production and remediation rates for contaminated sites.

Funding: Hatch Act Funds

Scope of Impact: Statewide

NATIONAL GOAL AREA 5: ENHANCED ECONOMIC OPPORTUNITY AND QUALITY OF LIFE FOR AMERICANS

During FY 2004, UVM Extension and VT-AES expended 19.94 FTE's and $2,742,360 toward enhancing economic opportunity and quality of life for Vermonters. Efforts yielded 32,389 contacts, 14, 678 of which were with youth. Efforts included the work of 4,277 volunteers who contributed a total of 54,132 hours (valued at $541,132, based on $10 per hour) toward implementing a wide array of programs.

UVM Extension programs are designed to empower people and communities through research-based information and education, to address the economic and social challenges facing our youth, families, and communities. Vermonters know that change is inevitable. For many Vermont communities, the type of change during the last 15 to 20 years was not favorable. While jobs dependent upon land and natural resources have declined, the cost of living in rural areas has increased. Outreach efforts over the past decade have assisted local communities raise more than $13,000,000 toward community development ventures, help 31 recreational enterprises to start-up and/or expand, develop a trail system receiving national recognition, and initiate community-based enterprises that have provided more than 100 additional jobs around the state.

Studies indicate changes in the workplace have led to declining levels of voter participation and increasing public apathy toward elections, as well as decreasing interest or opportunity to participate in volunteer activities and community groups. Municipal officer trainings and an annual conference for elected and appointed officials has improved communications and transition into public servant positions for more than 700 officers annually, thereby making it an easier step for a person to commit to serving their communities through government.

Younger generations lack interest in public affairs and lack of knowledge about our political system. Robert Putnam has quantified this civic disengagement, documenting a 25-30 year decline in membership in civic-oriented organizations. Youth programs have increased youth interest and involvement in their communities, including many community service efforts, some tied with public schools that have led to declining truancy and improved academic performance for participants.

UVM Extension has made a commitment to 4-H program growth and standardization, recognizing the value of alternative education approaches for youth. Vermont 4-H clubs show that life skill development occurs using this model, with 87% of youth participants reporting in a retrospective survey of ten indicators that they improved in one or more of eight life skills, such as self-responsibility, making healthy choices, using resources wisely, and developing useful and marketable skills. The experiential, hand-on model aimed at improving life skills and civic responsibility has widely recognized tangible benefits, but many youth do not have access to traditional clubs and may not be able to afford other 4-H experiences out of school, so these are being brought into schools as after-school and in-school programs. As a result of recent efforts, 4-H curriculum requests have increased and more schools are incorporating 4-H curricula and programs after school. For many of these programs, it is too soon to have feedback from students on program impacts, but the increase in partnership development with schools is encouraging. For those where student impact has been measured, results are very positive, showing increased academic achievement and increased school and community involvement by 95% of participants.

Education, highlighting communication skills and decision-making tools, empowers individuals and families to apply practices that result in increased involvement in their communities. Targeted youth and families receive concentrated programming in life skills to enhance their success as active productive community participants. Over the past five years, thousands of parents participated in parenting workshops designed to improve parenting skills for families at-risk of violence or dissolution. By working with the Vermont justice system, UVM Extension has been able to work with 26,000 divorcing or separating parents to improve their skills during this period of transition. Since the workshop is mandated by the State, many do not initially attend with the expectation of gaining new insights. However, after participating and reporting gains in parenting skills, attendees report overwhelmingly that they are glad the program is state mandated. Childcare programs have been initiated using current expert knowledge of family systems, with very positive results that show improved care of children for working parents.

KEY THEME: COMMUNITY DEVELOPMENT

TAKE CHARGE/ RECHARGE – Community capacity for directing change increases with skillful facilitation of community-based meetings to obtain citizen input. Take Charge and Recharge programs are designed to work with rural communities in need of community development action plans. At least 12 participating communities since the program inception in 1992 have moved from initiation through implementation to create significant positive changes, as a result of work initiated through a Take Charge/ Recharge approach to decision-making and action planning. These communities have been able to leverage $13,000,000 in support of community projects. Examples include:

- A town raised over $7 million to revitalize its downtown based on a plan developed using the process.
- One rural community's Take Charge Recreation Committee completed construction of their town playground. This committee was successful in raising over $70,000, in two years, to complete the project.
- An indoor recreation center for a rural county has been developed over twelve years after a Take Charge program identified it as a need in 1992. More than $4,000,000 has been raised since then to complete the building, where 14 people will be hired, and hundreds of families will be able to benefit through recreational opportunities the facility offers.
- A downtown revitalization committee secured over $1,000,000, completed improvements on Main Street including new sidewalks, plantings and lighting, as well as construction of a waterfront building on a local dock.
- A Recharge industrial development committee saw a need for more industrial land in their community. They were able to secure passage of a $500,000 bond to develop the infrastructure on purchased property. Today the property houses three businesses, including a large manufacturing company.
- When a ski company announced bankruptcy, local residents saw a need to recruit businesses. Efforts resulted in a successful brewery relocating to the area, development of a trails system that has enhanced summer recreation and employment opportunities in the area and received national recognition, and the purchase of the ski area by a local private school, thereby keeping it in operation. One committee member stated, "Whenever you want to accomplish something you need leaders, and Take Charge made some people step forward and be leaders. It is a lot of work, and some folks needed motivation to step forward."

- A Take Charge program in a rural county badly affected by economic woes associated with job losses due to company moves, included over 75 residents in attendance; in conjunction with the Vermont Sustainable Jobs Fund, they were able to secure over $100,000 in funding for a Jobs Coach position, and a coach was hired to assist with employment opportunities.
- A town desired a welcome center to assist with economic and community development. Through contacts, a UVM professional was able to link them with a UVM student, who produced a construction plan that has since received town zoning approval.
- A town saw a need to create parking for an increasing snowmobile industry, and a dock for a lake; more than $20,000 was leveraged for construction of the projects. One committee member gave tribute to the project's success to the Take Charge program: "We wouldn't have done it without Take Charge."

Funding: Smith-Lever

Scope of Impact: Statewide

TOWN OFFICER LEADERSHIP TRAINING – Vermont's 251 municipal units (cities, towns, villages, etc.) face increasing challenges in local governance. Small states operate on more marginal economies of scale than do large states, due to the limited tax base they can provide. Vermont, with a total population of 680,000 living primarily in rural areas, faces challenging economies of scale. At the same time, Vermont historically relies on strong local governance and decision-making at local levels. The vast majority of local municipal officials are part time or volunteer relying on citizens to serve in both elected and appointed positions. At the same time that volunteers are becoming harder to recruit, legislative mandates are making these jobs more complex, more time-consuming, and more vulnerable to litigation. Education and professional development are critical if these municipal officials are to conduct the business of their town in a professional, efficient, and legally-defensible manner. On-going training allows officials to stay current on legislative changes, develop skills to improve their job performance, and to share strategies and concerns with their peers in other municipalities. Unlike other learning opportunities available to this audience, Municipal Officers' Management Seminars and TOECs are unique in that they target officials from many different offices. A typical mix might include town clerks, treasurers, listers, selectboard members, planning commissioners, library trustees, health officers and zoning administrators. This mix creates a dynamic opportunity to build inter- and intra-community networks.

This past year, over 1,000 officials, representing more than 80% of Vermont's 251 cities, towns, and villages, participated in the municipal officers trainings. Approximately 1,000 officials, representing 86% of Vermont municipal units, participated in the Annual Town Officers Education Conference. Over the past decade, more than 10,000 local officials have been served through the programs. Results for this year's participants include the following:

- 60% stated they will be more effective in making decisions as a local official as a result of participation;
- 70% stated they received needed information to improve their job performance; and
- 55% stated that they expect to use information learned at the trainings while on the job "frequently" or "very frequently."

Funding: Smith-Lever

Scope of Impact: Statewide

KEY THEME: YOUTH DEVELOPMENT/ 4-H

4-H YOUTH OUTREACH – During FY 2004, 10,468 Vermont youth participated in one or more 4-H clubs (2,409 youth), camps (2,943 youth), and school enrichment programs (4,492 youth), with the majority of participants originating from rural communities and towns with populations under 10,000 people. Programs were possible through the contribution of 1480 volunteers. Approximately 20% of UVM Extension's total budget is dedicated to 4-H programming. We continue to provide statewide support for our wonderfully talented and dedicated 4-H volunteer leaders that work with our Vermont youth and with UVM Extension.

- Programs reached a higher percentage of racially and ethnically diverse youth (6.28%) than the state average (4.55% based on VT Department of Education statistics)
- Youth from ethnic and racial minorities represented a high proportion of this year's 278 4-H youth volunteers (12.23% of all youth volunteers).
- All Extension educators who work with club leaders now have youth participants complete self-reflective surveys to determine perceived changes in life skill development.
- Eighty-seven% of the youth involved in 4-H clubs reported an increase in important life skills such as leadership, communication, self-responsibility, healthy lifestyle choices, useful/marketable skills, and decision-making.
- Emails from parents showed they noticed the high proportion of award winning youth at a recent eighth grade graduation that were 4-H'ers. In fact, one parent noted the high quality public speaking skills of one of these youth, and commented on the role the 4-H experience had played in positive aspects of youth development.

Results also indicate that:

4-H In-School and After-School Programs – The UVM Extension 4-H Program serves as an educational resource for innovative community-based and service learning teaching strategies and models. 4-H's in-and after-school programming offers learning opportunities grounded in the local community, critical to promoting connected, purposeful and positive school experiences that contribute to the development of young people as healthy, caring and informed and active members of their community. School personnel have been enthusiastic about potential for success in applying the 4-H model for developing life skills to their in-school and after-school programs. Already, ten of 30 afterschool program providers who attended 4-H afterschool trainings purchased a variety of 4-H Cooperative Curriculum System (CCS) curricula for their program sites.

1) Technology and Teaching Using the 4-H Model – Seven schools in the state's most rural region, the Northeast Kingdom, have implemented 4-H in-school and afterschool programming. Evaluation of 218 fifth- and sixth-grade participants indicates that most students have made gains in the development of life skills in the areas of communication and wise use of resources: Navigation (84.21%), Weather and Climate (75.51%), and Exploration in Extremes (75.92%). Students enjoy and benefit from using GPS technology, solar balloons, solar beads, radiometers, spectroscopes, and other experimental instruments, as well as the "Science of Energy, Light and Lighting" curriculum from the National Energy Education Development (NEED) program.

Program coordinators were recently awarded funds through the ESRI GIS Technology Grant by USDA to further incorporate this technology into programs. UVM Extension's 4-H Educators are working with a group of students in one school to create the state's first 4H Technology Team. "This opportunity couldn't have come at a better time", stated one teacher. "The inquiry-based science program … was fun for the children and … each experiment brought up another set of questions; … having a ready supply of materials at hand made it possible to encourage the children to design additional experiments to answer those questions." The teacher also reported that the pre- and post- tests showed learning took place and that the Department of Energy's goal of a transferring knowledge from school to home was achieved.

UVM Extension has been a collaborator with the Northeast Kingdom Initiative (NEKI) for ten years and during that time have enjoyed working with 10 full time Americorps volunteer members (1700 hours each), 11 part-time members (900 hours each) and one 300 hour member. This totals 44,200 hours of volunteer time devoted to science and technology education for Northeast Kingdom youth. At $10 per hour this equates to $442,000 dollars of in-kind support for UVM Extension At- Risk Youth education. One of our full time members shares her reflection on the year of service this way: "Working with kids has been a wonderful experience for me. There is much reward in getting to know a child, learning what their capabilities are, what their needs are, and having a positive influence on their lives. Just a small amount of my time is enough to affect how a young person thinks about the world. When I realized this, I could not help but put everything I had into this work I did -- and that was the first time I cared so much about a job. It was then that I became aware that my future should contain work that is meaningful to the community."

2) Horticulture as Career Training Tool -- Work with lacking job and career skills teens in Vermont's southeastern region has shown that horticulture is an ideal platform for teaching job skills, especially since the results of their hard work are rapid and tangible. Fieldwork leads to harvest and sale of produce. Youth learn to market and sell their produce at a local farmers' market and in schools, and participants practice running their own small business and working with customers. In its first three years, more than 200 youth produced 17,763 pounds of produce, donating 9,357 to local hunger relief programs, and raising more than $3,500 through youth-centered enterprise projects. All participants report developing useful skills for job success, and most reported developing their skills in responsibility (60%), teamwork (60%) and communication (85%). Youth participants also mentored 110 younger children in four schools by increasing their knowledge of where their food comes from, and donate food to the local food shelf. Several of this year's 37 teenage participants entered the program feeling they entirely lack job skills, and left the program having secured unsubsidized employment elsewhere. The program's coordinator was selected to deliver a workshop about the program at the national CYFAR (Communities, Youth and Families At Risk) conference, where all participants reported that they learned useful lessons they could apply to their own programs.

3) Forests, Fields, and Futures – A teambuilding program centered on environmental conservation education has been created and implemented for middle-school at-risk youth. Youth collaborate with peers and adults to learn math, language, science, and technology skills while addressing environmental issues and community needs through experiential and hand-on learning options. Since the program's inception just three years ago, more than 300 at-risk youth have been served directly through the program and thirty educators have been trained to conduct parts of the program. Surveys and academic reports show that 98% of participating students improve academic success,

33% more students have made the honor role, significantly fewer students failed classes, and 66% of all seventh and eighth graders show improved decision making and team skills. As a result of the program, administrators identified a lack of team support from teachers and other school professionals occurring for seventh and eight graders as a problem area. Since that time, nine students identified as "at-risk of dropping out" received mentors and worked to develop individual academic plans, and have since reduced absenteeism and improved academic performance from "failing" to "passing" in all subject areas. Now, school support systems have been activated in all seventh and eighth grade at-risk cases, and ways to support ninth-grade students, who move from a set curriculum with five to seven teachers to a choice of 23 classes, each with different teacher. During the process, students report having been provided an environment in which they feel supported, safe, valued and capable, and that this will increase their potential for achieving personal and academic success. Meanwhile, as the third group of seventh grade students enthusiastically worked as a class in teams of six to prepare 88 campsites at a state park for the season, the State saved salaries of three park rangers for ten days.

4) Embryology Education Support – The 4-H Embryology curriculum has been used for twenty years in Vermont schools throughout the State. More than 50,000 students in grades K-12 have employed recordkeeping and teamwork skills while learning about chick incubation, development and hatching processes. 4-H curriculum use includes continued technical support, which proved useful to three grades in one school this past year. Hatching at one school had been unsuccessful after multiple attempts, even after directions had been carefully followed. Technical support turned into an in-class experiment comparing the teacher's incubator with one supplied by 4-H. Room temperature changes were discussed, and students concluded that their incubator could not sufficiently compensate for changes in weekend temperature. The solution they arrived at was that the teacher would pack the eggs and bring them home each weekend. This resulted in an 85% hatch rate (80% is considered good). The chicks were shared with students from previous classes who had had unsuccessful hatches, and helped them to recall what they had learned in the program. Based on a post reflective survey of ten indicators, more than 90% of 3,000 Vermont students participating in the 4-H Embryology curriculum report improvement in life skills, including teamwork, self-responsibility, and useful/ marketable skills.

5) Beefing Up the State's 4-H Dairy Program -- Vermont's 4-H horse club participants consistently place high in regional and national competitions, and has tremendous interest (916 club members this past year). Given the importance of dairy, sheep, and other livestock in the state's agricultural system, UVM Extension 4-H is working to provide similar levels of participation and impact for other livestock clubs. This year 694 youth participated in dairy, beef, goat, sheep, and other livestock groups – a twenty% increase over the previous year. UVM Extension 4-H educators implemented a statewide set of standards for all of these clubs that has increased participation and success rates of club members in state and regional events. A sampling of the outcomes include: a regional Dairy Challenge for cattle club members, similar to the Hippology contests held for the horse club members; six youth selected and participating in the National 4-H Dairy Conference in Madison, Wisconsin, including one youth with a sight disability who blossomed from the experience – this youth, initially keeping to himself, later volunteered during a foods workshop, gave a weather report for a group on a bus tour, and danced during a group activity; changes made to the State Dairy Judging Contest that helped increase participation by 300%; one dairy club who volunteered to be on a statewide commercial television show, Across the Fence, which led the youth to further develop teamwork, decision-making, critical thinking, communication and leadership skills; a reinstatement

of a dairy show in one county after a 20 year lapse; students responsibly participating in covering shifts to watch animals and displays at a county Field Days event, and a 300% increase in participation (from 23 to 71 youth, representing 75% of county members).

Youth and Volunteer Recognition – Youth in 4H learn skills in order to 'do' or 'make' something, and they also learn to follow-through and finish a task and exhibit their work. County fairs not only allow 4-H members to have fun, but to show what they have accomplished and learn from their and others' experiences. Through Horse Bowl, Hippology Quiz Bowl, Dairy Quiz Bowl and other knowledge-oriented competitive events, 217 4-Hers participated and engaged in healthy, informal (yet structured) educational programs in which they publicly demonstrated current knowledge as well as gained new knowledge through hands on experiences. Participants rated all activities provided as good or great, and 100% showed a desire to return the following year. In addition to learning about specific topics all youth participants gained valuable practice and opportunities for development of life skills (i.e. self motivation, teamwork, accepting differences, goal setting, and critical thinking skills).

Evaluation data being collected this year will give us an idea of the relative importance of competitive and demonstration events to 4H participants. This past year, the following examples highlight its impact:

- After a tough life, learning disabilities and unstable home environment, one young girl – after being in 4-H for 4 years and staying out of trouble -- was able to work her way up to Reserve Champion! This was no easy feat for her, but she had learned through perseverance, hard work, taking responsibility for her actions, listening and caring for her animals. This was a truly gratifying day in her life. She has also turned into an excellent mentor and leader for other club members. This was also great for other 4-Hers, who hadn't had the same challenges as she'd had, to see 'that it could be done'!!!
- Two Equus 4-H members met their leaders' challenge and the Presidential challenge to conduct 100 hours of community service during a one-year period. A 16-year old junior and a 15-year old freshman spent the year volunteering at summer camps, 4-H state events, and in their local communities through their schools' mentoring programs. During the December 2003 meeting of the Equus 4-H Club, the girls received letters of congratulations from President George Bush and the President's Council on Service and Civic Participation. After the award ceremony, both girls stated that they were eagerly looking forward to achieving the award again in 2004. Collaboration with programs like the Presidential Service Awards program help the 4-H community to capture the spirit of the 4-H slogan "4-H Can Make a Difference" as an example of the collective power of youth and the 4-H pledge.
- Four youth achieved the opportunity to attend the National 4-H Dairy Conference in Madison, Wisconsin. As a result of participation in workshops exploring agricultural careers, two of the youth are applying to colleges to continue their agricultural studies. Both were offered summer jobs in Wisconsin and are still deciding whether to stay there or return to Vermont to work.
- What started as a small bottle drive developed into a large-scale community service project to send 600 syrup containers to Vermont National Guard personnel posted in Iraq. The donated syrup and containers had a value of over $1500, and additional funds were raised to cover postage. All members who participated in the project were proud and gained

confidence in public speaking, accountability, and carrying out a large project as a team. Youth were thanked for their efforts.

Creating Cohesive Clubs – Attempts are being made to familiarize leaders with, and to have them implement, existing and revised 4-H protocols in order to insure uniform standards for curriculum delivery, recognition of members, and standard protocol for 4-H meetings and activities. A clearer understanding of 4-H protocol and policy both locally and statewide will result in a better and safer program for youth with more uniform standards. On going opportunities for two-way communication via e-mail, phone calls, and face-to-face visits allow leaders to become familiar with 4-H protocol and to have their concerns and queries addressed. Additionally, a series of "Letters to New Leaders" has been mailed to all clubs as a means of supplying leaders with easily digested snapshots of the 4-H program. A "reward" of curriculum materials has been made available (by the Chittenden County 4-H Foundation) to leaders who read the letters and have co-leader(s) read them as well. Communication with leaders from 22 clubs and with 10 UVM Extension 4-H staff members has resulted in the completion of 152 4-H records from members of 13 clubs, completion of all registration forms from 21 clubs, submission of seven 4-H club constitutions to date, treasury reports submitted by six clubs, and 64% compliance with updating volunteer driver safety paperwork. Although these efforts have created an additional heavy work burden for 4-H staff members, comments are positive, and they appreciate the direction toward the adoption of standard practices as part of 4-H policy and protocol.

A first attempt to assess impact of the 4-H Cohesive Statewide program on clubs showed that of 102 surveys returned, 33% of volunteer leaders report that they feel more connected to their 4-H educator contacts than they did a year ago, and 27% report they feel more connected to the 4-H program and the UVM Extension community. However, almost 60% reported no change in communication or connection to the program. A majority of respondents report that they believe volunteers are asked to do too much, and that the fun is being taken out of 4-H. Many reported that there is still too much administrative paperwork, leaving little time to really work with youth members on projects. As a result, many volunteers feel that it will become harder to find volunteers in the future willing to give such a commitment. Comments received showed that some long-time leaders and previous youth members feel the program shows a higher degree of professionalism. They also state that the website is more helpful and has critical documents on it, staff are better able to answer questions posed, and policies are more clearly understood. It may be that the surveys reflected the growing pains of transitioning toward greater goal-clarified standards for clubs.

Recent reductions in the UVM Extension state funding and faculty/staff positions highlight reliance of the 4-H program on dedicated and well-qualified volunteers. Volunteers serve multiple roles, as trainers, event organizers, judges, club or project leaders, chaperones, resource persons, and promoters. Volunteer leaders donate an average of about 120 hours per year per person, based on recent survey estimates, representing an estimated $720,000 in contributed effort by this year's 600 volunteer leaders alone. In order to provide leaders with the necessary resources and skills to meet the increasing demands of their job, a leaders' workshop was held at the end of the 2003-04 4-H year. Seventy percent of 4-H clubs were represented. Leaders sampled activities from various 4-H curricula, learned about the development of 4-H curricula, and were encouraged to implement a new project using 4-H curricula in the 2004-05 4-H year. To further promote the use of high quality experientially-based 4-H curricula, leaders were provided with a set of 4-H curricula at no charge.

To sustain this effort, an official request will be made to 4-H Foundations to assume the full or partial cost of a new set of curricula for each club each year.

Additionally, an Achievement night was held for parents and volunteers in each county, at which critical club protocols, such as why to use record books, how to use them, and how 4-H club members receive recognition were described and put in context with 4-H goals for youth. All leaders present planned to implement the protocols during the year. The next day a 4-H volunteer leader called a staff member to thank her for "turning on the light." This leader had felt utterly in the dark over the past year about what she was supposed to be doing with her youth members, and admitted she had been planning to stop volunteering as a leader. She said the meeting provided her with the first chance to really understand the process. After the meeting, she felt really encouraged to continue as a leader, since she now felt she would have the support and training she needed.

4-H staff members agreed by consensus at a recent meeting that all 2003-2004 goals had been met, that the team was working better together than a year ago, that communication had improved, that they have more clarity about responsibilities, and that they feel more united as a team.

Funding – UVM Extension hired a funding manager to oversee long term funding initiatives for 4-H and other critical under funded programs. The manager begins work in FY 2005.

Funding: Smith-Lever

Scope of Impact: Statewide

KEY THEME: CHILDREN, YOUTH, AND FAMILIES AT RISK

EXPAND CARING COMMUNITIES – Community partnerships and community-based education initiatives are developed for at-risk youth. Efforts center on a rural Vermont communities with higher than average rates of limited-income and unemployed populations. Assessments indicate success was achieved for both the Community Outcome and the Youth Outcome for UVM Extension's project. FY 2004 program impacts include:

- $47,742 in-kind and cash match provided by community organizations, agencies, service groups and government;
- 12 site project programs initiated/expanded, with 11 involving or led by volunteers;
- 19 community organizations, agencies, service groups and/or government officials collaborating to develop, sustain, and/or expand site projects;
- 664 youth reached with Life Skills development programming; planned observations and/ or Washington State Life Skills Evaluation surveys showed that 28% achieved behavioral change in one or more life skills evaluated; and
- 40 youth were reached with 50 or more contact hours.

This year, two forms were created for project staff to more accurately record in-kind and cash matches of collaborating groups in support of ECC programming; we anticipate a much larger amount reported in future years.

Funding: Smith-Lever

Scope of Impact: Multistate

COPING WITH SEPARATION AND DIVORCE – Parents going through the divorce/separation process are likely to pay less attention to parenting, thus beginning a negative cycle of adjustment that may result in school failure, delinquency, and other physical, social and psychological problems for youth. Since 1993, Extension and the Vermont Family Court have provided information to more than 26,000 parents who completed a 4-hour workshop to help their children cope with family change. Exit responses of 2,158 parents show that 83% agree the class will help them; 87% intend to use something learned; 59% do not resent that the program is court mandated; and 34% would attend class even without mandate. Program has been developed into an interactive on-line curriculum and pilot testing within and outside the state continued through FY 2004.

Funding: Smith-Lever

Scope: Statewide

SYSTEMS APPROACH TO CHILDARE – With many parents in the workplace, child care providers are essential in the development and care of children from infancy through school age. With multiple family configurations and changing family dynamics due to divorce and other factors, child care providers need ways to think through challenging or unfamiliar situations that involve children and families. Child care providers are in a unique position to influence positive youth development, especially in situations where conflict or stress arise Twenty-five child care providers, who reach 246 children, participated in a two-hour workshop entitled, "Systems Thinking and the Child Care Professional," an application of Bowen Family Systems Theory. Results from 22 participant evaluations indicate that knowledge increased from a mean of 1.9 (low) to a mean of 4.1 (high); 77% found the information highly useful; and 68% desired to learn more on this topic. Participants commented that the workshop included "very important ideas for child care providers to use" and "a new way of thinking and processing [that] could be very useful." Providers planned to apply the knowledge in their work in various ways, such as this attendee, who said she plans to take a "more objective, non-reactive approach in provider/parent interactions."

Funding: Smith-Lever

Scope: Statewide

B. UVM EXTENSION AND AGRICULTURAL EXPERIMENT STATION STAKEHOLDERS

At UVM, the "Research-Extension-Vermonter" connection is a continuous, responsive cycle. UVM Extension and Vermont Agricultural Experiment Station rely on the input and advice from many Vermonters to help determine the relevance and quality of programs and research projects.

VERMONT AGRICULTURAL EXPERIMENT STATION BOARD OF ADVISORS

The Vermont Agricultural Experiment Station is advised by the Board of Advisors for the College of Agriculture and Life Sciences. This Board consists of leaders in agriculture, small business, sustainable agriculture, food and nutrition, biology and life sciences, rural community development, higher education, and public affairs. Board members are appointed by the Dean of the College of Agriculture and Life Sciences, who is also the director of the Vermont Agricultural Experiment Station, and consist of a Board chair and two standing committees -- executive and nomination. Terms for members are for three years, with members allowed to serve up to two consecutive terms. The Board meets two times each year to advise the College of Agriculture and Life Sciences and Vermont Agricultural Experiment Station, and other times at the discretion of UVM's president and provost. In addition to assisting Vermont Agricultural Experiment Station in identifying trends, issues and new developments in each of the CSREES-defined national goal areas, the Board advises the group on formulating strategies, setting priorities, developing resources, reviewing program plans, and cultivating relationships to bring about learning experiences, field-based research, and employment opportunities for students.

UVM EXTENSION ADVISORY GROUPS

Individuals serving on UVM Extension advisory boards and councils are essential to the evaluation of existing programs and the planning of new programs. UVM Extension meets with a State Advisory Board and receives advice from regional and program-oriented advisory committees. Stakeholder input for UVM Extension is explained by describing how it is obtained for program areas within each national goal area.

Extension advisors and other Vermonters help guide Extension programs in agriculture, natural resources and environmental management, nutrition, food safety, and health, and family and community resources and economic development. The following are just some examples of programs developed in consultation with a network of UVM Extension faculty and staff and advisors--including clients, commodity groups, and other Extension, Experiment Station, or University colleagues--to help determine the best use of limited resources, the most effective way to deliver a program, and opportunities for creating partnerships.

STATE ADVISORY BOARD
UVM Extension has been working diligently to cross disciplinary boundaries in obtaining and using stakeholder information and advice. The State Advisory Board is composed of twelve members having expertise and career experience corresponding to one or more National Goal Areas. This group provides direct and frequent input to the Extension Director and Assistant Director.

REGIONAL ADVISORY COUNCILS

Each of the three regions has an Advisory Council with representation in all National Goal Areas. Councils meet between four and six times per year and provide input to Regional Chairs, faculty and staff.

PROGRAM ADVISORY COUNCIL
Specific program areas receive input from additional advisory boards.

Agricultural needs and interests for the state are served by two "teams" and sets of program advisors – The Dairy Team and the Diversified Agriculture Team. Agricultural Business Management program has an advisory group that is composed of a banker, dairy producers, non-livestock producers, FSA employees, and representatives of industry. This board provides input relative to the structure and content of Agricultural Business Management workshops conducted throughout the state.

- Tax Management School receives formal input on an annual basis from the Internal Revenue Service, the Vermont Tax Commissioner, and private tax accountants relative to the design of curricula for tax management workshops.
- The renamed Rural Agriculture Vocational Rehabilitation Program (RAVR) has active citizen advisory groups in the Northeast and Northwest Regions. These groups provide valuable input and provide a support network for disabled farmers and rural residents. Vocational Counselors receive input on program delivery and strive to address the needs of clientele.
- Diversified Agricultural interests are assessed through "Discussion Groups" conducted throughout the state on various commodity-based topics. These groups meet on a regular schedule to discuss issues affecting their sectors. UVM Extension faculty and staff members serve as facilitators for these groups. This past year UVM Extension asked all dairy farmers about programming interests through a mail survey.
- Other Vermont agencies having an interest in the agricultural sector are also consulted. A close working relationship exists between Extension and the Vermont Department of Agriculture. Many cooperative programs exist, and ideas are routinely exchanged via individual visits, telephone conversations and electronic mail. Extension professionals also readily interact with USDA FSA and NRCS personnel on both formal and informal bases. Similarly, Extension professionals maintain working relationships with personnel in local conservation districts.
- Because of the small size and populations of many New England states, multi-state interaction is a necessity for effective programming. Expertise is readily exchanged across state lines. Formal interaction is facilitated through regular meetings among agricultural program leaders and Vermont program area representatives. In 2001, an agricultural directory was developed listing expertise of Extension professionals in Vermont, New Hampshire and Maine. Faculty and staff participate in numerous multi-state programs and maintain functional informal relationships with counterparts in other states.

Food Safety and Health program personnel receive input from many stakeholder groups, including UVM faculty from the department of Nutrition and Food Science, UVM Sustainable Agriculture Center, UVM Extension Nutrition, Food Safety and Health Curriculum Team Advisory Group, Vermont Food Bank, Northeast Organic Farmers Association, Education and Training Council, Vermont Department of Health, Vermont Department of Education, Food and Markets, Vermont Department of Agriculture, Vermont Department of Aging and Independent Living, Southwest

Council on Aging, Vermont Restaurant Assoc., Vermont Manufacturing Extension Center, AARP, Vermont Campaign to End Childhood Hunger, Serve New England, Vermont Department of Employment and Training, Head Start, Community Action Agencies, Farmer's Market Association, Vermont Specialty Food Association, Vermont Fruit and Berry Association, Conference on Food Protection, Vermont Association of Child Care Resources and Referral Agencies, mental health associations, Vermont Department of Children and Families, Area Health Education Centers, childcare providers, food service managers and food producers.

To maintain an engaged stakeholder population UVM Extension faculty initiate and sustain regular communications, and involve stakeholders in programming and impact analysis. UVM Extension personnel use both formal and informal approaches to engage stakeholders. The formal approach includes group process, focus group interviews, and retreats. Three priority areas were selected for programming: Food Safety, Food Security and Practical Education Nutrition and Food Preparation information. In 2000, the advisory group determined it was appropriate to allocate resources to diabetes education and to enhance our efforts to reach Vermont's senior citizens with nutrition and food safety information. Food stamp monies have helped to offset the costs of these new initiatives.

Informal contact with stakeholders regarding food safety, food security, and nutrition programs take place daily as UVM Extension personnel work with members of their communities to plan and implement their programs. Results of a survey of local food shelves and community kitchens conducted by the Vermont Food bank has been used by UVM Extension to determine what types of nutrition and food safety workshops should be conducted to help Vermonters with limited resources. It is UVM Extension's goal to continue to address issues specific to Vermont, enhancing the quality and impact of these program efforts by engaging in collaborations with land grant institutions across the nation, with the research and teaching faculty at UVM and with other Vermont agencies and institutions.

Stakeholder input regarding Balancing Land Use and Natural Resource Management involves consultation with four major groups landowners in control of natural resources management; users of Vermont's natural resources; organizations interested in natural resource management; and individuals interested in natural resources management. Information on programming to meet the needs of these stakeholders comes from a variety of means. These include using surveys, personal discussions, memberships on boards and committees, and including a wide range of representatives on Extension boards and councils.

Input that was received included the need to address the economic basis of natural resources management within Vermont and balance this use against the desire to maintain a sustainable resource that meets the needs of a diverse population. There is a desire among youth to know more about their role in maintaining a sustainable environment and community while developing a sense of place.

Community and Economic Development initiatives benefit from the input of a ten-member advisory council representing a variety of agencies and organizations as well as community volunteers. These people have varied backgrounds and bring diverse perspectives to discussions and decision-making. The advisory council meets twice a year, receives informational mailings & telephone calls, and additionally, using e-mail technology, participates on a Community and Economic Development listserve. Annually, members provide advice related to programs during our planning period and

help to set priorities for the team. The most recent advisors' assessment was in April 2002, when they ranked each of the potential programs based on their experience and sense of community need.

VERMONTER POLL

Working with UVM's Center for Rural Studies, the Vermont Agricultural Experiment Station and UVM Extension seek input from an annual Vermonter Opinion Poll. UVM Extension has supported this effort of conducting the representative survey of Vermonters since 1990. UVM utilizes responses to poll figures, in addition to recommendations made by other stakeholder groups and expert sources, to define research and outreach program foci on agricultural, economic, health, and environmental issues.

C. PROGRAM REVIEW PROCESS

UVM EXTENSION

A comprehensive system of state, regional, and curriculum advisors has contributed greatly to the ongoing, informal review of UVM Extension programming. In response to AREERA, a more formal merit review of outreach activities was conducted in May 1999. Two reviewers from each of UVM Extension's four curriculum/program teams' advisory groups were selected to systematically review all proposed curricula. Reviewers were asked to rate each curriculum plan according to the following criteria:

- **Impact** -- programs have high potential for producing a measurable, positive impact on Vermonters
- **Resource availability/accessibility** – resources exist to implement programs successfully
- **Reaching diverse audiences** – programs are likely to meet needs of diverse underserved audiences
- **Customer demand** -- programs are linked to clearly articulated customer need
- **Collaboration** -- potential exists for collaboration within and between states and institutions
- **Innovation** -- programs are unique or are not done well by others

Results of the merit review process were shared with members of the UVM Extension program management team that included the chairs of on campus and regional units and program teams. Extension representatives continue to meet with the State Advisory Council four times per year to evaluate the merit of past, current and future programming.

UVM Extension has since implemented a program development process integrating the Logic Model and Outcomes-Based Evaluation concepts into an adaptive management framework, improving our ability to effectively respond to the needs of Vermonters. The focus in our framework is a logical development of programs to obtain specified outcomes, and the use of feedback loops to better respond to shifts in resources, audiences, and goals, and was described in detail in the FY 2003 Annual Report of Accomplishments.

Applying the model, Extension faculty and staff members work together to determine how each individual, group, and team can best contribute to UVM Extension goals by looking at the composite UVM Extension Curriculum Plan (the five program-based curriculum plans combined) during the upcoming year. Teams, groups, and individuals use this information to develop Personal Performance Plans describing their unique contribution(s) to the UVM Extension Curriculum Plan, including what they plan to do, and for what target audience. Individuals also utilize their expertise and the set of indicators provided in Curriculum Plans to define how they will measure their progress in achieving goals. During each quarter, individuals review Personal Performance Plans and report on progress toward goal achievement through Statistical Summary Reports describing what they accomplished, who they reached, and outcomes and impacts observed and measured. Personnel also have access to plans and reports of all other faculty and staff members, allowing them to modify and coordinate plans during the year.

Curriculum Plans, information about available resources, and an annual report summarizing actual outcomes and impacts collected using an online database, are shared with advisors and other stakeholder groups to gather feedback regarding the quality of our accomplishments, gaps in

progress, and recommendations for changes in direction based on new information gleaned over the year. We rely on, and receive, active participation and input of well-appointed advisory group members when establishing, evaluating, and revising our goals and objectives each year. Extension teams likewise evaluate progress and available resources, and incorporate new information gathered from our advisors. Data from committees and stakeholder groups are then used to revise the next year's Curriculum Plan, including changes made to goals and performance indicators.

In this way, UVM Extension utilizes quarterly and annual feedback loops that involve individual, program committee, external, and organizational evaluation and revision processes to improve program relevance and effectiveness on a continuous basis. A flexible, "real-time" on-line integrated program for planning and reporting is used as an information sharing mechanism for all stages of program development.

As the process has evolved, we obtain richer information. Faculty and staff reports have become more outcome and impact oriented. Input from our advisors, who diligently apply the data and their knowledge of state needs and other servicing agencies to a customized "MacMillan Matrix", has been more useful. As a result, we have had shifts in program direction taking place since this system has been introduced. Some of these shifts were driven by changes in staff numbers and positions. Some people in the organization have moved to higher priority issues, as outlined by program teams in Curriculum Plans, developed with the input from statistical summary report data and advisors, as well as other stakeholders. Feedback from employees indicates that the newer program development framework provides a better opportunity to obtain quality data from advisors. We are re-evaluating our mechanisms for obtaining stakeholder feedback, including the process used for selecting advisors, in order to ensure that we obtain useful, representative, balanced information to help us proceed toward fulfilling our mission. We are also working to better track cumulative information for our longer-term programs, and to better describe cumulative impacts relative to expectations.

This year efforts have moved to better defining priority program foci and working to further incorporate university research with outreach programs. To this end, completely cross-disciplinary groups have produced white papers on eleven key state issues. Further formal review by advisory groups, administrative staff, and program faculty and staff will help us to better define long term program strategies that best meet Vermont needs, organizational strengths and partnership potentials.

VERMONT AGRICULTURAL EXPERIMENT STATION

The Vermont Agricultural Experiment Station awards Hatch funding annually through a competitive, rigorous peer review process. Reviewers represent faculty from a variety of disciplines. Proposals are judged in the following areas:

- Problem Statement – Is the problem well justified? Will this project enhance the capacity of VT-AES to attract new resources or to generate knowledge?
- Importance of the research to Vermont
- Scientific and Technical Feasibility
- Overall assessment of scientific merit
- Past record of accomplishment of P.I.(s) and/or potential for future success
- Budget justification

- Potential for timely application or transfer of results.

The review process is for all Hatch funded research, including regional projects. Proposals may be approved with or without funding. Approved proposals are sent to USDA/CSREES for final approval at the federal level. A copy of Hatch proposal review guidelines is appended to this report. Since the implementation of this competitive review process in 1994, the Vermont Agricultural Experiment Station has witnessed a marked increase in research proposal quality, and an increase in the absolute amount and% of funds leveraged through external sources.

A rigorous review process is also held for funds set aside from Hatch and Smith-Lever monies to fund projects that effectively inform the Vermont public through a combination of research and outreach. Vermont Integrated Research and Extension Award (VIRECA) proposals are merit and peer reviewed by a panel consisting of research and Extension faculty as well as stakeholders representing research and Extension constituencies. Eligible proposals must include at least one VT-AES and one UVM Extension faculty member, and must be clearly linked to at least one the five national goal areas and priority areas identified by our advisors and stakeholders. These priorities include food safety; food security; rural communities; and water quality. The program has funded four projects since FY2000. Additionally, two new projects were funded for FY2005-2006.

D. Evaluation of the Success of Multi and Joint Activities

As part of the national land grant system, UVM Extension and Agricultural Experiment Station are involved in a variety of multi-state outreach and research activities that address the five national goal areas. Many of our agricultural research and outreach efforts involve other states, since Vermont and many neighboring New England states are small in size and population. Sample sizes and economical outreach numbers often improve when efforts are combined. Appendix C, Table 2 shows that $479,729 in federal and state funding supported more than twenty multi-state programs conducted by UVM Extension and VT-AES.

Despite the relative lack of racial diversity in the state (census figures show that approximately 97% of Vermonters are Caucasian/White), there are other characteristics of Extension clients and stakeholders that identify target populations as underserved for educational programming and human service efforts. Examples of these populations include rural people and communities (more than 80% Vermont's area is rural); limited-resource Vermonters; small scale agricultural producers; people affected by disabling injury or disease; women; and children, youth and families at-risk. Below, multi-institutional, multidisciplinary, integrated, and multistate activities are described in relationship to identified stakeholder interests and concerns. The reader will note from these descriptions that by combining resources and personnel effort with other institutions, planned programs met and exceeded expected outcomes and impacts for the period, and program effectiveness and efficiencies were improved.

Highlighted Activities

Stakeholders have a strong interest in reducing soil, water and airborne chemicals and their negative effects on the environment and quality of life, while also strongly supporting farms and agriculture as sustainable businesses and lifestyles for Vermonters. They show a keen interest in protecting water through reduced high-nutrient run-off, changing land use patterns, and a reduction in conventional pesticide and herbicide use.

UVM research and outreach specialists have been collaborating with Penn State University to update software (Crop MD) that uses soil test values, manure test values, animal unit descriptions, and intended cropping practices to help farmers develop farm- and field-specific nutrient management plans to reduce non-point-source pollution from livestock waste. Personnel then train farmers to use the Vermont CropMDv3_VT computer database program to record activities and plan for improved farm practices that will increase profitability and reduce non-point source pollution. To date, 450 users have been trained in using the software (and have copies of the software); 130 agency personnel are trained and certified to interpret the summary output submitted to the Natural Resource Conservation Service (NRCS) / Farm Service Agency (FSA) for evidence of program participation compliance; 120 farmers have developed nutrient management plans using the software to mange nutrient loads on the farm; 85% of respondents to a follow-up survey felt that the software was excellent to good as a tool for improving their nutrient planning and record keeping ability; and 100% of respondents indicated an improvement in farm profitability as a result of using the program. Reducing the phosphorus content in feed, creating buffers, and receiving advice from consultants, provides dairy farmers with a cost-effective mechanism for maintaining water quality as herd size grows. Methods are now in progress for collecting data to address changes in water quality indicators for Vermont waterways.

We serve the only multistate AgrAbility audience, working with ATECH in NH to identify and analyze cases of shorter term disabling events affecting farmers, and assisting them through these crises, preventing loss of farms and livelihoods. This program augments the RAVR program, as these people face a disabling event-oriented crisis, but do not fall under the rigorous, long-term definition of "disabled" set by RAVR. In its first year, Vermont completed nearly 30 farm site assessments, assisting 26 farmers in the process to maintain most or all of their farm income during a disabling crisis period.

The Watershed Alliance project focuses on youth education and outreach related to watershed and coastal water quality around the Lake Champlain Basin. The project is supported by USDA, UVM School of Natural Resources, and Lake Champlain Sea Grant dollars. While UVM Extension is focused on watershed management and stewardship, colleagues at State University of New York -- Plattsburg offer expertise in fisheries for the bi-state Lake Champlain Sea Grant program. The efforts have created youth-led actions resulting in safer water for communities. Vermont has been working with New York to bring Vermont's Watershed Alliance curriculum and program coordination to middle school students in New York. This program has helped thousands of students learn how humans impact waterways, and the results of these impacts on water quality and associated water uses. Actions to improve water quality, such as changing water systems providing drinking water for residents, have been taken by some communities in response to findings presented by students. Data are being used, through Sea Grant and other a partnerships, by UVM, ECHO at the Leahy Center, and NY researchers, to develop baseline and longitudinal data on Lake Champlain water quality indices.

Insect pests pose serious problems for apple and greenhouse growers that limit productivity and crop values. New England greenhouse growers wish to reduce reliance on chemical insecticides, as these compounds are costly, and pose risks to applicators and the public. Chemical insecticides are losing efficacy due to increasing insect resistance. In cooperation with colleagues throughout New England, UVM research and Extension specialists continue to undertake cutting edge research and deliver educational information to aid greenhouse growers in adopting safer integrated pest management strategies. Success in this area has helped the greenhouse industry to "blossom" in this region of the country. Examples of recent successes include research and outreach that has improved what greenhouse growers know about fungi that can supplant conventional sprays to reduce insect pests; about spraying techniques and tools that reduce by 10 to 50% the amount of pesticides used while increasing spray effectiveness; changing greenhouse flooring to eliminate overwintering insects without resorting to chemical pesticides; and numerous other integrated pest management strategies. This past year, Vermont produced the New England Apple Pest Management Guide in coordination with other New England states.

Through use of laptop computers in the home, nutrition educators used an on-line nutrition curriculum that is designed to be interactive, and specifically targeted to individuals and families with limited resources. More than 200 participants have shown nutrition gains. UVM Extension food safety specialists are working with faculty from New England, NY, WI, and WV on food safety programs that emphasize reducing microbial contamination on produce. Food safety curricula have been developed, used to train instructors, and disseminated throughout the country, based on the combined efforts of UVM Extension, University of Rhode Island, University of Connecticut, and the University of New Hampshire. Pooling resources made what may have otherwise been a daunting task for any one state to complete, quite feasible and effective in reaching a large, critical audience.

Program participation in the voluntary program was limited as there was a lack of perceived urgency and perceived benefit by many producers. Positive outcomes include:

- 16 farmers earned GAP certification (Rhode Island and Connecticut); and
- 14 audits were completed (NH), with farmers making one or more changes to operations.

The bovine mastitis project is an excellent example of how UVM researchers work with other states to combine resources and develop a product with impact. VT-AES researchers are active participants in a study of mastitis-resistant animals involving colleagues from 13 states as well as Canada and England. This work has led to scientific breakthroughs that could significantly improve animal health and welfare and potentially save the dairy industry millions of dollars. The key to these scientific advancements has been the cloning and modification of a gene that helps destroy bacterial cells that cause mastitis. UVM researchers changed the lysostaphin gene sequence so that the protein would be manufactured directly, and only, by an animal's mammary cells. The UVM gene has been used successfully in a collaborative effort with scientists at the U.S. Department of Agriculture laboratory in Beltsville, Maryland, who have produced mice that are resistant to mastitis. USDA and Vermont scientists also are working with the UVM gene to produce a mastitis-resistant cow. "The beauty of lysostaphin is that it only attacks the staphylococcal bacteria that cause mastitis. It has no impact whatsoever on other cells," says John Bramley, lead researcher. Bob Wall, a USDA research physiologist collaborating with the UVM scientists, states, "We have had this goal, since the technology became available, to improve milk production characteristics of farm animals to benefit the animal, the producer, and the consumer. UVM has come up with the potential gene needed to do this."

UVM Extension agricultural specialists are working closely with the University of New Hampshire to improve the business acumen of farmers. Agricultural Business Management courses taught to Vermont and New Hampshire audiences improved business knowledge, use of business plans, and success in financing business decisions by farmers. A recent letter from University of New Hampshire Extension Dairy professor and specialist, John Porter noted that Vermont's collaboration with New Hampshire has increased farmer participation in programs, whose educational experience is improved by the complementary facilitation styles of the two state's Extension representatives. Additionally, he noted that Vermont's longstanding work in the program offers program continuity, which improves program effectiveness. Typical results show that more than 70% of attendees apply what they learn in the course to their own operations. As a result of the impact it has had on farm management, monetary support for farmers to attend the class has been extended by Vermont Farm Credit, Lyndonville Savings Bank, VEDA/VACC, St. Albans Coop, Agrimark, Vermont Land Trust, Dairylea, and Dairy Farmers of America, among others.

The Women's Agricultural Network (WAgN), originally funded through a USDA Technical Assistance Program, provides education and technical assistance for women farmers and introduces them to the services and programs of the USDA. One objective of the program is to develop federal, state and local partners to provide women with a comprehensive continuum of services. Since its inception in 1995, WAgN has grown to include 1,040 members in Vermont, and more than 189 out-of-state members. While 635 individuals have received technical assistance and 780 have attended workshops conducted through WAgN, 1,600 households actually subscribe to the WAgN quarterly journal. WAgN has served as a model program for newly started WAgNs in Maine and New Hampshire. Since the program's inception in 1995, more than two hundred members have

completed business plans, and the WAgN program has expanded to two other states (Maine and New Hampshire).

Working with a KY-based CYFAR Liaison, and people from IA, AZ, and Penn State, several projects have been initiated and expanded as part of an umbrella to Expand Caring Communities and Engage Youth in Communities. During the previous funding period (1996 to 2001), 4,450 youth were reached in five communities with life skills programming, with 69% of this population demonstrating at least one positive behavior change. The second funding period began in mid-2002 and has so far achieved the following impacts:

- $47,742 in-kind and cash match provided by community organizations, agencies, service groups and government;
- 12 site project programs initiated/expanded;
- 11 programs involving or led by volunteers;
- 19 community organizations, agencies, service groups and/or government officials are working in collaboration with the site projects.
- 664 youth reached with Life Skills development programming;
- based on planned observation and Washington State Life Skills Evaluation post-reflective surveys (when applicable – ages 12 and up), 185 youth (28% of those reached) indicate behavioral change has occurred in one or more of eight Life Skills evaluated; and
- 40 youth reached with 50 or more contact hours

Other highlighted multistate projects include:

- Precision agriculture for fruit growers using foliar analysis (see Page 6 for impacts)
- Coordination of New England Vegetable and Berry Conference, New England Fruit Meeting, and Trade Show (see Page 7 for impacts)
- Agricultural program expansion and sustainability efforts (see Page 18 for impacts)
- Nutrient management software development and recordkeeping outreach (see Page 35 for impacts)
- Developing novel culture controls for thrips in Spring bedding plants (see Page 43 for impacts)
- Improving community-based decisions about recreational tourism through participatory modeling (see Page 44 for impacts)
- Developing sustainable strategies for land use in the Northern Forest (see Page 46 for impacts)
- Investigating nitrogen movement through forested ecosystems in the Northeast (see Page 47 for impacts)

F. INTEGRATED RESEARCH AND EXTENSION ACTIVITIES

An effective method of integrating research and outreach funded through Hatch and Smith-Lever funds is through the split appointment of faculty in UVM Extension and other University of Vermont departments. During FY 2004, 16 faculty had split appointments in the following departments: Animal Sciences; Community Development & Applied Economics; Plant & Soil Science; Nutrition & Food Sciences; Rubenstein School of Environment and Natural Resources; and College of Education and Social Services. Extension funded salaries toward 7.63 FTE's and VT-AES funded salaries toward 3.15 FTE's, with the balance funded through department funds and grants. In addition to teaching and research, faculty members are assigned to Extension curriculum/program teams and play active roles in developing and implementing outreach programs. During FY 2004 nine integrated projects were supported through $400,792 in Hatch Funds and $839,382 in Smith-Lever funds (Appendix C, Tables 3 and 4).

To encourage greater collaboration and integration between University of Vermont research and Extension faculty, a pool of targeted funds has been developed to support a competitive grant proposal process—The Vermont Integrated Research and Extension Award (VIRECA). Funding for accepted proposals comes from a fund joining Hatch and Smith-Lever funds. Research proposals are merit and peer reviewed by a panel consisting of research and Extension faculty as well as stakeholders representing research and Extension constituencies. Eligible research proposals must include at least one VT-AES and one University of Vermont Extension faculty member, and must be clearly linked to at least one the five national goal areas and priority areas identified by our advisors and stakeholders. Current priorities for proposals include:

- Food Safety
- Food Security--increasing local consumption of Vermont grown foods
- Rural Communities--the Working Landscape and Workforce Development
- Water Quality--reducing non-point source pollution, alternative nutrient management and feeding management strategies

The program has funded six projects since FY2000, including the following four projects active during FY 2004:

Program	Impact and/or reference
Farmer's market for community and agricultural development	Impacts reported FY 2003 (average weekly vendor income for newly created farmer's market in economically depressed area increased (~$125 per vendor); five new vendors joined; certified to participate in Farm to Family Food Coupon program; sponsored "Shop Fresh with the Chef" event); no new impacts reported in FY 2004, although organizational change is leading to a self-sufficient operation; data too preliminary to report.
Development of phosphorus index for farm use	Phosphorus index completed and field tested; 32

	nutrient management planners (crop consultants, industry consultants, and USDA/ state agency staff) trained in 2-day hands-on workshops (see Page 39 for more detail)
Investigating the effectiveness of internet delivery of nutrition, food safety and health information to Vermont's elderly	Study involved production of a web-based nutritional education program and outreach to 41 seniors to test its effectiveness in improving nutrition; results of nutritional risks survey food behavior checklist, focus groups, and computer attitude survey at baseline, 3 months, and 12 months show that the use of the web application had a strong positive impact on the nutrition and health behaviors of study participants, and was successful at helping seniors utilize a wide assortment of internet health resources.
Organic dairy farming: profitability analysis and educational program development	Project initiated in FY 2004; study will produce first statistically valid data on organic farming profitability relative to conventional farms through data collected during FY 2005, and develop educational programs to share information with agricultural and consumer audiences.

Other projects that effectively combined research and outreach activities to achieve impacts for Vermont citizens include the development of novel culture controls for thrips in Spring bedding plants; multidisciplinary evaluation of a biopesticide alternative (Kaolin) for fruit growers; identifying and addressing farm biosecurity needs; and developing Vermont-grown collaboratives and markets (see Page 18 for impacts).

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the 5-Year Plan of Work
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution___University of Vermont Extension_____
State_____Vermont_____

Check one: _X_ Multistate Extension Activities
____ Integrated Activities (Hatch Act Funds)
____ Integrated Activities (Smith-Lever Act Funds)

Estimated Cost Title of Planned Program/Activity	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
NGA1: Competitive Agriculture_____	_71,367	120,532	118,449	158,380	272,386
NGA2: Food Safety_____	_17,329	_25,526	_24,947	_57,700	_11,159
NGA 3: Nutrition _____	__1,472	_-------_	_-------_	_-------_	_------
NGA 4: Natural Resources & Environment	_30,885	_10,400	131,456	_80,926	_------
NGA 5: Economic Opportunity/Quality of Life	_19,133	102,218	183,192	209,334	196,183
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
Total	**140,186**	**258,677**	**458,044**	**506,340**	**479,729**

_____ __3/14/05_____
Director Date

Form CSREES-PLAN (2/00)

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution__Vermont Agricultural Experiment Station_____
State__Vermont_____

Check one: ____ Multistate Extension Activities
__X__ Integrated Activities (Hatch Act Funds)
___ Integrated Activities (Smith-Lever Act Funds)

Actual Expenditures

Title of Planned Program/Activity	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
NGA1: Competitive Agriculture_____	224,721	254,956	218,501	281,251	251,306
NGA 2: Food Safety_____	9,292	36,741	30,139	27,823	-0-
NGA 3: Nutrition_____	9.292	27,357	133,724	53,864	3,029
NGA 4: Natural Resources & Environment	117,496	77,925	145,682	228,746	67,288
NGA 5: Economic Opportunity/Quality of Life	99,972	48,385	59,987	60,394	79,170
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
Total	460,773	445,364	588,033	652,078	400,792

_____ ___3/14/05_____
Director Date

Form CSREES-REPT (2/00)

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution__University of Vermont Extension_____
State__Vermont_____

Check one: ____ Multistate Extension Activities
____ Integrated Activities (Hatch Act Funds)
__X_ Integrated Activities (Smith-Lever Act Funds)

Actual Expenditures

Title of Planned Program/Activity	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
NGA1: Competitive Agriculture_____	249,240	309,544	480,466	503,880	495,405
NGA 2: Food Safety_____	__4,646	_88,404	_90,326	_64,519	_23,392
NGA 3: Nutrition_____	__4,646	_30,012	_26,910	_43,410	_67,387
NGA 4: Natural Resources & Environment	164,893	108,148	_83,984	116,603	232,431
NGA 5: Economic Opportunity/Quality of Life	109,235	_78,543	145,184	149,329	_20,767
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
Total	532,660	614,651	826,870	877,741	839,382

_____ ___3/14/05_____
Director Date

Form CSREES-REPT (2/00)

University of Vermont Extension and Agricultural Experiment Station Total Resources for FY 2004

FY2004 Human and Fiscal Resources

Human Resources FY2004	Extension		Agricultural Experiment Station		Total
National Goal Area	Professional FTEs	Para-professional FTEs	Professional FTEs	Para-professional FTEs	
1: Competitive Agriculture	9.21	0	8.9	5.6	23.71
2: Food Safety	.96	0	3.4	2.0	6.36
3: Nutrition	3.76	.37	1.1	3.6	8.83
4: Natural Resources & Environment	2.84	1.0	2.1	1.3	7.24
5: Economic Opportunity/Quality of Life	9.10	8.44	0.9	1.5	19.94
Total	25.88	9.81	16.4	14.0	66.09

Expenditures for FY2004	Extension		Agricultural Experiment Station		Total
National Goal Area	Federal	State	Federal	State	
1: Competitive Agriculture	437,459	870,989	684,245	1,044,475	3,037,168
2: Food Safety	45,746	91,081	139,748	409,864	546,831
3: Nutrition	196,376	390,989	185,792	297,526	1,070,683
4: Natural Resources & Environment	182,672	363,703	248,452	476,060	1,270,887
5: Economic Opportunity/Quality of Life	833,106	1,658,732	128,578	121,944	2,742,360
Total	1,695,358	3,375,494	1,368,815	2,349,869	8,789,536