Certification of Vermont Annual Report of Accomplishments and Results (FY 2005)

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Annual Report of Accomplishments and Results
FY2005

Executive Summary

The Vermont Agricultural Experiment Station (VT-AES) was established in 1886 to advance scientific research to serve Vermont's rural and agricultural and needs. Since its founding in 1912, University of Vermont (UVM) Extension has worked to translate researched-based conclusions into information that Vermonters can use. Extension concentrates on research that helps farmers, gardeners, forest and land stewards, and rural communities improve business profitability, economics, nutrition, food safety, and youth and adult life-skills development. Today, VT-AES and UVM Extension address issues ranging from farm profitability, water quality, soil quality, and dairy herd disease resistance and health, to global climate change, renewable energy, obesity, youth education in science, and healthy community development.

During 2005, VT-AES conducted 176 new or ongoing research projects representing more than $8.5 million. Extension's combined $7 million budget, including grants and contracts, reached more than 96,700 contacts state wide. This tally does not even account for Extension's large presence at events such as the "Everything Equine" show, regional fairs, annual farm and flower shows, in the media, and on the "Across the Fence" weekday television show.

"Partnership" seems too small a word to describe the complex community ties that make this important work happen—work that touches so many Vermonters' lives. The efforts of our state and federal representatives and those who garner private research funds are remarkable in this era of fiscal constraints. Our work is guided and evaluated by dedicated citizen advisors with whom we meet regularly to review priorities, spending and program impact, and we seek feedback at every Extension event, via surveys, and state-wide polls. We meet with university, local, state and national opinion leaders, and policymakers to review our research and outreach portfolio and direction. This report includes VT-AES and Extension's most visible, high-impact work.

With a dramatic shift in Vermont's agriculture landscape continuing—58 farms quit dairying in 2005, yet the number of farms remains steady as farmers pursue many other diverse forms of agriculture—farm profitability is among the foremost skill sets that VT-AES and Extension can offer. Dairy farm profitability is obviously tied to the health of the herd. Mastitis, a bacterial infection of cows' udders that is difficult to control with antibiotics and results in lower milk production and discarded milk, costs farmers more than $2 billion annually. Years of USDA-partnered molecular biology research on gene transfer paid off in 2005, when a VT-AES researcher genetically modified the first dairy cows resistant to a widespread and painful form of mastitis. Building on previous VT-AES work, the lab produced the gene that enables cows to make a naturally occurring enzyme in their milk that appears to ward off one form of mastitis. Researchers also made progress in 2005 in isolating and reproducing a microbial enzyme that may prove deadly to *Streptococcus uberis,* a pathogen that causes some 25 % of all bovine mastitis cases in the U.S. Other researchers are studying how hormones influence mammary gland development and milk production. Pigs are the subject for mammary-gland biologist Russ Hovey's research. Hovey's work has application to both the swine and dairy industries as well as breast cancer research by determining whether a pigs' mammary glands react biologically in the same ways as human mammary glands.

More than a dozen Extension faculty colleagues conducted the Crop Insurance Education Program for Vermont Farmers—a one-year, $226,000 project funded by the USDA's agricultural risk management partnership that was renewed. A study of the profitability of organic dairy farming also began in 2005. Vermont researchers split more than $300,000 with the University of Maine to survey and tally the net profit of a sampling of farms in the two states. Yet another project that continues through 2006 involves holding workshops throughout New England to aid farmers in transferring their farms to family members and others. The Farm Viability Enhancement Program is another approach to this issue. UVM Extension and Center for Sustainable Agriculture engage farmers in custom-tailored business planning. Doubling its outreach numbers in its second year, 98 farms–representing more than 35,100 acres of productive farmland–have been referred to the program. In 2005, four UVM Extension faculty and staff helped 20 Vermont farms create business plans. They tackle farm management practices, transfer issues, business diversification, and product marketing.

Farmland is inextricably tied to the ecosystems beyond its fence rows, and both farmers and researchers work together toward sustainability along with profitability. VT-AES and Extension are literally and figuratively testing the waters through innovations in handling run-off, converting natural resources into energy and tapping indicators of climate change. UVM Extension and VT-AES have been developing models of natural watersheds, and testing strategies of constructed wetlands and phosphorus filters technologies to reduce pollutants from farm effluent. Projects beginning in 2005 include phosphorus and nitrogen removal and transformations, greenhouse-gas emissions measurements and investigations of the flow patterns in constructed wetlands using tracer studies.

UVM Extension is working to integrate alternative forages into dairy cropping systems to improve profitability, soil conditions, and environmental quality. Results from a two-year workshop and mentoring program on developing healthy soils for farmers has shown dramatically more environmentally friendly ways in which farmers are approaching nutrient inputs to soils. Work continues to educate and to understand barriers to low-input methods for maintaining healthy soils while saving money for farmers. VT-AES researchers are using nematodes and microarthropods as biological indicators of soil quality, and for environmental monitoring. Researchers are quantifying contributions of soil organisms to nitrogen availability in arable soil, identifying potential non-target effects of genetically modified corn on soil organisms, examining ecosystem productivity and stability of arid soil as it relates to climate change, and monitoring microbial communities to assess soil quality and progress of remediation of waste sites and contaminated sediments. Additional research is improving our understanding of how plant roots function to increase ability to absorb water and nutrients from soil, and to reduce disease resistance without additional chemical inputs. Work has also been done to evaluate the genes and characteristics of invasive species that contribute to their aggressive influx.

Obesity is a problem of epidemic proportions in the U.S. Health problems associated with obesity threaten to crush the nation's medical-care system. In keeping with the size of this crisis, one of largest competitive grants ever received by the Vermont Agricultural Experiment Station is the work of Jean Harvey-Berino and colleagues. A $3.5 million National Institutes of Health grant expands the number and diversity of participants of the successful VTrim Internet weight-

loss research program. Harvey-Berino, a nutrition and food scientist, and her collaborator Delia Smith West of the University of Arkansas believe that if new studies continue the success rate of previous work, VTrim could be useful as a model of low-cost, high-reach obesity treatment. Because online participants lost an average of 21 pounds in six months, Harvey-Berino's work received national media attention, including in 2005, *USA Today* featured VTrim in a six-week series.

A new science and technology 4-H project was launched in the rural southern Vermont town of Whitingham. Middle school students in the Wings 4-H Tech Club learned basic GIS/GPS remote sensing skills, then applied them to create a visitors' map to Lake Whitingham, thanks to UVM Extension 4-H staff leadership and a partnership with the Trans Canada natural gas company. The club went on to present another project—the story of the town that once was Mountain Mills—at Whitingham's Town Meeting Day. In 2005, Extension launched the pilot 4-H program: Science of Energy, Light, and Lighting. Eighty-five youth learned the scientific concepts behind use and learned about its impact on the environment, economy, and society. The program conducted in five Vermont communities included principles of 4-H life skill development and addressed Extension's goal to enhance youth involvement in communities as active, productive citizens. This project was a partnership among Extension, the Department of Energy, and Office of Energy Efficiency and Renewable Energy to promote an energy-conscious society. Vermont was one of seven states involved.

The success of strong facilitation skills and innovative means of bringing community members together to solve community problems have yielded more than $13 million in grants that have assisted communities in improving the lives of their residents. New technologies, such as "participatory modeling" approaches, are being tested as aids to moving communities more quickly from division to consensus, and from inaction to action.

In an era of flat federal budgets, UVM scientists and outreach specialists continue to do cutting-edge research and outreach, because they are highly competitive and successful in being awarded grants and contracts. UVM Extension and VT-AES receive federal funding from the USDA which is matched by state funding. In fiscal year 2005, 41% of Extension expenditures were funded by the state and 19% were supported by federal Smith-Lever funding. Additional grants and contracts brought in more than $1,365,000. During that same period, 27% of Vermont Agricultural Experiment Station expenditures were supported by the state, 12% were covered by federal Hatch funds and competitive grants, and contracts accounted for 57% of the budget—or nearly $4.9 million.

In 2005, Extension hired its first development officer who, within the year, helped UVM Extension and the State 4-H Foundation triple the amount of money raised to support 4-H. Development continues working with faculty, staff, and long-time supporters to recover costs of programs and find revenue from foundations, agencies, and individuals. UVM Extension also works to help people understand the range of programs we provide and our connection to the knowledge-base of UVM faculty. Staff and faculty have contained program costs while still making UVM Extension accessible to all who are interested. UVM Extension focuses on addressing selected critical problems in Vermont, so UVM Extension programs yield the greatest impact.

A. Planned Programs

National Goal Area 1

Overview: 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 used 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 to 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; and 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.

During FY 2005, UVM Extension and VT-AES efforts and resources were combined successfully to support a healthy and diverse agriculture linked to healthy communities and the natural environment. 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 $96,525 based on $15 per hour.

VT-AES researchers developed the first transgenic mastitis-resistant cow, providing the potential for healthier cows with fewer antibiotic treatments, and relief from a $2 billion annual cost to dairy farmers. Additional mammary research has improved understanding of factors affecting mammary health, such as identifying and cloning the enzyme that has anti-streptococcal activity, and milk production, providing opportunities for strengthening Vermont's largest agricultural industry.

Farming is expensive in Vermont and produce sales receipts can be volatile, making risk management a necessary tool for farmers. While production and farm health are key factors,

farmers have requested assistance in business development and financial management as a basis for decision making to create more sustainable farms. This makes sense for Vermont, where many farms have been in production for generations and show high productivity, yet do not always have the profits to show for their efforts. Through innovative partnerships with multiple state and regional partners, UVM has funded the Vermont Farm Viability Enhancement Program, which has helped 98 farmers overseeing a combined total of 31,500 farm acres to make long-term farming and management decisions. Sixty of these farms have either already completed, or are completing full, long-range business plans. Results are diverse and impressive, ranging from changing farm niches and tripling profits and net worth, to changing health insurance and saving $10,000 annually. In other cases, financial management has led to quality of life improvements, such as providing farmers with the opportunity to take their first vacation in years, or feeling secure after having successfully transferred the farm to a future generation.

As new health information emerges and consumer purchasing habits change, agriculture needs to stay a step ahead of the curve. Vermont must also be able to improve its market share by increasing the length of the sales season in this cold climate. Vermont has been a leader in developing cold-hardy wine grapes, and Extension is working to help new viticulturists succeed in this expensive and competitive market through research on cultivars; through information outreach on growing, soil, and integrated pest management strategies appropriate for the region; and through workshops and on-site visits to assist with site-specific problems. Research and outreach are also helping farmers to reduce energy costs and increase the length of the growing season through innovative means. During an annual horticulture conference, 1,300 attendees estimated that information gained from the conference will reduce business costs by an average of $860 per attendee, increase sales by an average of $6,870, and lead each grower to grow ten new crops in FY 2006. A video describing innovative crop cover techniques for and featuring vegetable farmers has reached over 4,000 farmers from 200 videos sold since its release in FY 2005. Recent evaluations showed that approximately three fourths of purchasers have used the video directly in their jobs, and share the video with an average of 20 people each.

Goal 1

Allocated Resources

Research:

Hatch Funds:	$ 689,200
All Funds:	$2,872,516
FTE's:	7.4

Extension

Smith-Lever Funds:	$ 430,383
All Funds:	$1,389,693
FTE's:	9.1

Goal 1

Key Themes: Agricultural Profitability
Animal Health
Animal Genomics

Activity: Mastitis is the most costly disease of dairy cattle, affecting milk production, milk quality, cow health, farm workloads, as well as veterinary and pharmaceutical expenses. Approximately 30% of dairy cows will experience a course of mastitis during their annual lactation cycle. The estimated cost of this disease to the U.S. dairy industry is two billion dollars per year. Antibiotic therapy is currently a major part of management strategies to prevent or cure mastitis. UVM has worked at a Maryland laboratory to generate transgenic animals that have enhanced resistance to mastitis. These animals require less antibiotic treatment. The mammary glands of these animals produce new antibacterial enzymes that target mastitis causing bacteria.

Impact: UVM researchers successfully collaborated with researchers at USDA/ARS in Beltsville, Md. to produce transgenic cows with enhanced mastitis resistance. Kerr and colleagues also made progress in 2005 in isolating and reproducing a microbial enzyme that may prove deadly to *Streptococcus uberis,* a pathogen that causes some 25% of all bovine mastitis cases in the U.S. Results have since been published in a high profile scientific journal. The transgenic cows produce the anti-staphylococcal enzyme, lysostaphin, in their milk and are highly resistant to mastitis caused by *S. aureus*. The researchers have also made good progress on identifying and cloning the enzyme that has anti-streptococcal activity. It is anticipated that such an enzyme will be effective in prevention of streptococcal mastitis. This enzyme was discovered in a bacteriophage residing in a strain of *Streptococcus uberis*, a major mastitis pathogen. Another aspect of the research is to identify infection-responsive genes in the bovine mammary gland. The controlling elements of these genes may be effective to control transgenic production of anti-bacterial enzymes. We have used a genomic approach to simultaneously evaluate the endotoxin responsiveness of approximately 20,000 genes in the bovine mammary gland. Our preliminary data indicates that approximately 200 genes are activated by more than two-fold within four hours of exposure to *E. coli* endotoxin. The genomic results are now being validated by a more accurate technique (real-time RT-PCR). This research is part of a three-year study funded by the USDA-National Research Initiative. The research was reported at the 2005 annual meeting of the American Society for Microbiology in Atlanta. Transgenic cows offer the potential for farmers to produce large quantities of high quality milk while reducing disease and relying less on antibiotics for their cows.

Sources of Federal Funds: Hatch, USDA-National Research Initiative

Scope of Impact: State Specific

Goal 1

Key Themes: Agricultural Profitability
Animal Health
Animal Genomics

Activity: Mastitis is the most costly disease of dairy cattle, affecting milk production, milk quality, cow health, farm workloads, as well as veterinary and pharmaceutical expenses. Mammary gland epithelial cells are likely to be important in defending against mastitis, yet little is known about their response mechanisms. Development of an accurate model to study infection-responsive genes in cell culture will allow efficient testing of new strategies to prevent mastitis. Primary cell cultures from four Holstein cows were prepared and frozen. The cell cultures from each cow were then thawed and maintained separately, yet simultaneously, and exposed to treatments that included infection with *Staphylococcus aureus* or exposure to an endotoxin from *Escherichia coli*. Clear inflammatory responses occurred and were recorded in detail under different doses of *S. aureus* or toxin. Researchers compared the results from the cell culture model to results obtained from tissue samples obtained from endotoxin challenged dairy cows. The cows were challenged by intramammary infusion with a low dose of an LPS endotoxin to simulate infection by *E. coli*.

Impact: Researchers have developed a cryopreserved bovine mammary epithelial cell culture system and identified a large number of genes that are activated by infection. The responses seen in the cell culture system appear to accurately reflect that seen in samples from inflamed bovine mammary glands. Results indicate that mammary epithelial cells play an important role in inflammatory response, through the production of pro-inflammatory cytokines, an acute phase protein, and lactoferrin. Results confirm the usefulness of the cell culture model to study infection responses of mammary epithelial cells, where all cells are simultaneously exposed to the same infection pressure. These responses can be studied over time, and most importantly biological replication is provided by the four different genotypes being investigated individually.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

Goal 1

Key Themes: Agricultural Profitability
Animal Health
Animal Genomics

Activity: Profitability for dairy farms is strongly affected by annual milk production per cow. Glucose uptake by the milk-producing cells in the mammary gland is the rate-limiting step for milk production because glucose is the major precursor of milk lactose which controls milk yield. UVM researchers seek to better understand how glucose transporters affect milk production and how these might be modified to enhance milk production without negatively affecting cow health. Researchers cloned the glucose transporters in bovine tissues playing key roles in maintaining glucose homeostasis in lactation in order to determine the location, structure, function and expression of genes affecting health, reproduction, production, and product quality in cattle.

Impact: Results suggest that the expression and developmental regulation of bovine mammary gland glucose transporters play an important physiological role in milk synthesis. Further studies using the cloned DNA and information gained about the distribution of the transporters will shed light on their functional roles and regulation in various bovine tissues to support milk synthesis and to maintain body glucose homeostasis.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

Goal 1

Key Themes: Agricultural Profitability
Diversified/Alternative Agriculture

Activity: Cold climate winegrape production is an emerging new crop in the diversification of agriculture in Vermont and northern New England offering exciting value-added and agri-tourism economic opportunities. Interest in cold climate winegrape production is high in the region and Vermont growers have become the early adopters, the leaders and pioneers of the emerging cold climate grape industry to whom prospective growers from other states are contacting for information, insights, and advice. A key challenge to this young industry is the selection of winegrape cultivars which will consistently produce high quality fruit under Vermont's variable environmental conditions. High quality fruit is the basis for quality wine production and cultivar selection will impact the vineyard's competitiveness and profitability for many years. Vermont grape growers have identified cultivar evaluation research as a top priority (2004 UVM Grape Industry Survey, unpublished). It also has been acknowledged as important by Vermont's Secretary of Agriculture, Steven R. Kerr. Most of the grape cultivars already planted are being grown on a trial basis by the growers because no testing of the adaptability, productivity, and fruit and wine quality has been conducted in the region. It is a very risky and expensive situation for growers given the cost associated with planting one hectare of grapes is approximately $12,000 to $20,000 and it takes a number of years to determine whether a cultivar is suitably matched to our environmental conditions.

Work in 2005 included evaluation of cold-hardy winegrape cultivars by identifying and quantifying differences in performance of grape cultivars grown in locations with microclimatic, cultural, and pest management differences; documenting growers' experience in growing grapes in colder climates; and developing an outreach program for grape growers in Northern New England.

Impact: Outreach with growers has helped approximately twelve vineyards to become active in Vermont, and more are in the planning stage, with between 30 and 40 acres of grapes in the ground at this time. Considering that one acre can produce 4-5 tons of grapes, and approximately 3,000 bottles of wine per acre, Vermont viticulturists can produce about 100,000 bottles of wine annually. Vermont has at least four wineries, and more in the planning stages. Visits to the cooperators' vineyards have developed strong partnerships between grape growers and Extension personnel. Vineyard visits have helped meet the needs of grape growers for technical assistance on topics such as new vineyard site preparation, disease and insect pest management, and nutrient management. For example, a new grower was planning to apply manure fertilizer to the site of a new vineyard despite the results of a soil test that suggested adequate soil nutrients.

Data collected on bud survival after winter low temperatures of selected cultivars at the cooperating vineyards in 2005 showed differences in bud survival between cultivars in different locations. Data collected on yield per vine, average cluster size, average berry size, soluble solids content, and pH of the targeted grape cultivars are currently being statistically analyzed. Vine growth was monitored during the 2005 growing season and the dates that target cultivars reached specific phenological stages were recorded and posted on the Cold Climate Viticulture Web

page. Grape berry moth populations were monitored in each vineyard during the 2005 growing season and data were posted on the Cold Climate Viticulture Web page. Additionally, an in-depth assessment of grape berry moth and leafhopper infestation, as part of an IPM system, was conducted at each vineyard in July and in August following the Cornell protocol. Results of individual vineyards were communicated to growers. Disease incidence and severity were rated for the target cultivars at each vineyard in September of 2005. Differences in disease incidence and severity of the cultivars 'Reisling,' 'Leon Millot,' 'St. Croix,' and 'Frontenac' at Vineyard 1 were compared in a publication produced from these results. A regional workshop for cold-climate grape management reached 32 people, and others had to be turned away due to space limitations. The result has been improved canopy management, which has positive impact on fruit quality, disease reduction, and cold hardiness. Growers have used information from the workshop to solve problems related to overly vigorous vines. Growers have used pest assessments in their IPM programs for making decisions about management.

The Vermont grape growers' database that was created in 2004 with the results of a grower survey has been updated to include new growers in 2005. The survey includes information that profiles the emerging wine grape industry in Vermont and pinpoints areas of priority for research and technology transfer. Priorities included cultivar performance and cold hardiness in Vermont, the development of an IPM program for grapes in Vermont, and cultural practices for cold climate grape growing. The University of Vermont Cold Climate Viticulture Web page (http://pss.uvm.edu/grape/) is now available to current and prospective grape growers in Vermont and the region, and contains a primer on integrated pest management, links to newsletters and growing season observations from the field. Research progress and outreach success have led to UVM's selection as a participant in a nation-wide grape cultivar adaptability study.

Sources of Federal Funds: Hatch, Smith Lever 3 (b) & (c)

Scope of Impact: Multi-state (CA, CO, IA, IN, MA, MD, ME, MI, MN, NE, NY, PA, SD, TX, VA, VT, WA)

Goal 1

Key Themes: Agricultural Profitability
Diversified/Alternative Agriculture

Activity: The growing season in Vermont is relatively short and cold compared to other horticultural production areas. As a result, early- and late-season markets are often lost to more southerly and westerly growers. To optimize profitability and expand markets, Vermont's growers need to adopt new production practices that allow them to extend the length of the growing and thus the marketing season, enhancing the quantity and quality of crops produced and sold. These practices include the use of row covers, plastic mulches, high tunnels, and greenhouses. Each of these techniques involves a constantly evolving set of materials and methods available to the grower, and they must be assessed in a logical fashion in order to decide how and when to use them, alone or in combination. Over 1,300 attendees improved greenhouse practices for profit, and personal and environmental safety at this year's UVM-sponsored New England Greenhouse Conference.

Seminars received an average rating of 3.6 out of a possible 4.0 maximum value to participants. Attendees estimated that information gained from the conference will, on average, reduce business costs by $860, increase sales by an average of $6,870, and lead them to grow ten new crops in FY 2006. 90%, or 1,170 attendees, visited the trade show of 150 vendors, with 24% making purchases, spending an average of $2,665 per purchase to buy new products. This resulted in $746,200 in sales for vendors (nearly $5,000 per vendor), and new products and crops accessed by growers to improve their businesses. A video describing innovative crop cover techniques for—and featuring—vegetable farmers has reached over 4,000 farmers from 200 videos sold since its release in FY 2005. Recent evaluations (n=91) showed that approximately three-fourths of purchasers have used the video directly in their jobs, and share the video with an average of 20 people each, while also lending it out to others (53%) for workshops, college and high school classes, farm crews, and 4-H youth. The video shown in Idaho, Utah, Arizona, and Nevada has encouraged sustainable farmers to investigate covers that thrive in their regions. In Tajikistan, the video has led to cover-cropping of 3,000 hectares of farmland.

Sources of Federal Funds: Smith Lever 3 (b) & (c)

Scope of Impact: Multi-state (MA, ME, NH, NY, RI, VT)

Goal 1

Key Themes: Agricultural Profitability
Risk Management

Activity: The primary needs declared by Vermont farmers during FY 2003 and 2004 were more agricultural business management, and financial training and assistance. More than 1,300 farmers have been helped over the past three years to develop business plans and receive referrals for additional assistance from experts. During 2005, UVM personnel conducted five Agricultural Business Management classes, with 77 attendees from 58 farms, and four Farm Transfer workshops in New England, with 120 participants during FY 2005.

To meet the needs of farmers, innovative programs such as the Vermont Pasture Network linking grazing farmers, Land Link Vermont linking farmers and non-farmers interested in selling and purchasing farm land, UVM's Small Ruminant Dairy Project, and UVM's modified version of the Dairy Profitability Enhancement program (DPEP) have been successfully implemented. In 2003, in response to concerns over the changing economics of agriculture, the Vermont Housing and Conservation Board and the Vermont Agency of Agriculture, Food, and Markets created the Vermont Farm Viability Enhancement Program. The program offers Vermont farmers help with business planning and technical assistance to help them improve and develop their agriculture business. After meeting strict requirements, farmers meet on their farms, at no charge, with expert planners and technical assistance providers who endeavor to help the farmer find and implement the solutions that will work best for each farm. The participating service providers include the Intervale Foundation, Northeast Organic Farming Association of Vermont (NOFA-VT), UVM Extension, the Vermont Small Business Development Center, Working Landscapes, and individual farm business consultants. Technical assistance can come from industry, university, consultants, or farmer mentors. The goal is to help to provide each farm with both the planning and implementation resources to increase the farm's ability to achieve sustainability. During 2005, the program will begin a series of year-two evaluations to assess the effectiveness of prior work and to define what further resources are needed to assist the farms.

Impact: The Farm Viability Enhancement Program provided business planning/technical assistance to 48 dairy and diversified farmer applicants, 20 of whom completed full business plans. All completed enterprise budgets, refined book-keeping practices, or were referred to farm transfer planning, Extension's Dairy Profitability Enhancement Program, Land Link Vermont, NxLevel business planning classes, or market assessment services. Since its inception two years ago, 98 Vermont farms representing 31,500 acres of productive farmland have been referred to the Farm Viability Enhancement Program. Workshops and approximately sixty farm visits over the past three years have yielded more than twenty successful farm transfers, representing approximately 1,800 acres of farmland.

More than 500 families have participated in UVM Extension's Land Link Vermont (LLVT) service, making connections among farm seekers and farming opportunities. Currently the service has 123 enrollees. Survey results conducted with the assistance of a UVM undergraduate student found that 68 % of farm seekers were currently farming on either leased or owned land. Results showed that farm-seekers' greatest challenges revolve around finances (e.g., start-up

costs, ongoing cash flow, cost of farmland) and their greatest need is business management education. Land Link offers support for new farmers and farm families making transitions to the next generation. Fifteen workshops and courses were organized by LLVT during 2005, attended by 523 farmers and service providers. During 2005 LLVT partnered with the Vermont Small Business Development Center to offer a "Tilling the Soil" business management course in three sites across Vermont. This enabled 45 farmers to participate, with more than 90 % of participants stating that the course met their expectations and they planned to use the information to begin or expand and existing agricultural business, or revise business objectives.

Since its inception in 1998, personnel working with the Small Ruminant Dairy Project (SRDP) have visited 163 farms and provided 1,800 individual client consultations. The project has organized and sponsored 97 workshops and conferences reaching 2,200 people. More than 450 people regularly subscribe to the SRDP newsletter. This past year the SRDP hosted the 11th Annual Great Lakes Dairy Sheep Symposium, where 40 % of the 120 participants stated they learned strategies that will save them money. To assist sheep and goat farmers involved in cheesemaking, a milk-metering technician visited farms to measure individual ewe milk production and take samples for testing milk components that affect cheese yield. Farmers have used this information to select the next generation of replacement ewes to increase overall milk production and cheese yields.

Some 2005 individual successes include the following:

- A dairy farm showed improved financial data recordkeeping, increased accuracy in reporting, and increased milk production. With this effort, net farm income increased from (-$66,000) to +$54,000 in three years, and net worth increased by approximately $150,000. Changes enabled this farmer to take his first vacation in years.
- Outreach work with an egg producer resulted in the farmer obtaining a loan for the purchase of new pullets to expand the operation. This farmer doubled egg production to 680 eggs per day, and began selling in two cooperative markets while looking to sell into a third. The farmer stated, "We cannot tell you how much we appreciated [UVM Extension's] help." Changes have enabled the farmers to purchase their farm, add a greenhouse, and expand their business into other niche markets.
- One farm followed a recommendation to change health insurance, saving 50% from previous years' bills. The $10,000 savings makes a big difference in cash flow on this 66-cow farm.
- By working with a farmer to develop a budget, the farmer was able to make a decision to convert to organic production, as he was able to a see possible profit for the ailing farm by making the switch. This farm is now shipping organic milk. In addition to increasing profits, the son and daughter-in-law have now become more interested in the farming operation than they had been before.
- When family members decided not to take over the farm of an aging farmer, UVM Extension assisted the farmer in finding a new employee, which kept farm from going out of business. This employee has been at the farm for about a year now, still working full-time. The farm owner is pleased and looking forward to retirement in a couple of years.
- Personnel helped one farmer raise funds to bring a midwest speaker to Vermont. UVM Extension partnered with NOFA, Land Link Vermont, Vermont Pasture Network, and Shelburne Farms to put on program, attended by 30 farmers from three states that learned

about the economics of grass-based dairy farming, and by 15 farmers who learned about share-milking for new farmers.

Sources of Federal Funds: Hatch, Smith Lever 3 (b) & (c)

Scope of Impact: State Specific

Goal 1

Key Themes: Agricultural Competitiveness
Plant Health
Plant Production Efficiency
Animal Production Efficiency

Activity: "Dirt on Soil," a three-day integrated soil learning course was developed by farmers to support agricultural producers seeking to enhance soil health and promote crop productivity and quality of their operations. The course was limited to 40 participants, and various learning styles were employed, including practical hands-on learning, farmer-to-farmer mentoring, and on-farm technical workshops held by farmers that participated in the courses. Topics included soil science principles that underlie soil health; advanced knowledge of soil management to build healthy soils; and exploring links between soil health, and short- and long-term crop health; and a day-long reunion class for farmer participants (23 of 40 returned) to discuss experiences making changes to achieve more sustainable soil management. Additionally, eight participants received at least 25 hours of additional guidance by working with an experienced farmer-mentor to establish goals and farm management plans. Three farmers from the class hosted on-farm technical workshops used to demonstrate practices that the farmer had learned and integrated into their farming system as a result of the course.

Impact: Forty farmers participated in the "Dirt on Soils" research and outreach program, with a waiting list required. All participants surveyed (n=30) reported increases in knowledge of soils. Follow-up evaluations showed that 75% of the farmers made changes in soil management to increase soil health. Changes on these farms included reducing compaction, adding more organic matter to soils and increasing crop diversity. Listed below are quotes from two participants.
"Please do more workshops like this. Great format, great instructors, and great energy."
"Great program! We have needed this for years."

The 23 participants who returned for the reunion commented that they had seen changes in crop quality and soil health. All of the eight mentored farmers made at least two major changes to their soil management practices. One participant stated the following: "In 2004, I died and went to heaven. I was fortunate to be able to participate in the courses 'Dirt on Soil' and 'Greening the Farm.' For the two years previous, I had been reading about and trying to find people to explain soil fertility and rotational grazing but without a lot of satisfaction. Then I discovered the 2004 VT Grass Farmers Annual Conference which led to the soil and pasture courses. I was so excited I could hardly sleep—all that information and then a mentor to answer all my questions. You have no idea how special this was for me. I would love to support others as this course has supported me. This year, I will be having at least one pasture walk on my farm. I am rotationally grazing all of my pasture land for the second year and completing my fertility plan as well as exploring the energetic aspects of soil management."

Farmer-hosted workshops displayed many changes made to the cropping systems on the farms as a direct result of the course and the farmer-to-farmer mentoring. One farmer, who hosted the technical workshop "Organic Forage and Grains", said that last winter he had changed his way of thinking about farming; his words were as follows:

“The Soils and Crops Course put on by UVM Extension last spring completely changed my way of farming. I now know that if I take care of my soil everything else will fall into place. Good healthy soil translates into healthy high yielding crops and healthy high producing cows.” The farmer stated that the program has provided him with direct economic, environmental, and social benefits.

Program design has enabled UVM Extension outreach professionals to maintain contact with over half of the original course participants. The continuous learning process has enabled farmers to continue making progress and allowed UVM Extension to monitor longitudinal impacts of an educational program over a longer term.

Sources of Federal Funds: Hatch, Smith Lever 3 (b) & (c)

Scope of Impact: State Specific

Goal 1

Key Themes: Agricultural Competitiveness
Alternative Agriculture

Activity: The recent surge in fossil fuel prices has focused attention on the fact that the price and supply of diesel fuel is likely to be unstable in the future, posing an economic risk to farmers. One solution is to develop alternative and renewable sources of on-farm energy, such as biodiesel, which is made from vegetable oil, alcohol, and lye. If some or all of the ingredients can be produced and processed on the farm, it would promote energy independence, economic development, and a more sustainable fuel-food cycle.

To address changing energy and information needs for farmers, UVM hosted a forum on Alternative Farm Energy that brought in 79 farmer, educator, and agency participants. Topics included on-farm production of biodiesel, converting furnaces to burn waste vegetable oil, methane digester technology, willow biomass fuel production, and wind and solar power use on farms.

Impact: Based on a 68% survey sample, more than 95% stated that the forum improved their understanding of alternative energy options, gave them appropriate ideas of areas for further exploration, and provided them with resources or people they will contact at a later date. More than two thirds of participants stated they planned to make an energy-related change in their farming operation as a result of attending the forum.

Sources of Federal Funds: Hatch, Smith Lever 3 (b) & (c)

Scope of Impact: State Specific

National Goal Area 2

Overview: Each year, 6.5 to 33 million people suffer from symptoms of foodborne illness and 5,000 will die. These numbers are estimates because most food related illnesses go unreported. The cost of these illnesses has been estimated at any where from $10 to 83 billion a year in medical and legal expenses, and work time loss. UVM Extension personnel have 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 have improved school sanitation practices for 4,000 students and 22 schools through youth and adult-oriented workshops, school- and county fair-based outreach efforts. Outreach efforts have assisted food processing and handling businesses develop and implement HACCP plans. Researchers are developing useful techniques for making foods such as milk and cider safe, while maintaining nutrient and taste quality.

The number of people being served at emergency food sites continues to grow despite the fact that emergency food does not provide low-income Vermonters with a sense of security about their future food resources. Many people who are eligible for food stamps are not participating. UVM researchers developed a food stamp outreach Web site (www.vermontfoodhelp.com) to reach underserved Vermonters with information and procedural assistance. Within one year, 919 households, totaling 2,218 residents, had applied for food stamps using the site rather than through traditional means, and 82% were approved for participation; 22% were seniors and 69% were households with children.

As a state with $500 million in agricultural receipts, Vermont is also working with agricultural agencies to develop emergency preparedness coordination and training opportunities, and to update the 1996 Emergency response plan to complement VT Emergency Management's State Support Function 11. UVM Extension has developed a Web site focusing on biosecurity issues as a means of disseminating this information to the public (www.uvm.edu/~ascibios/).

Goal 2

Allocated Resources

Research:

Hatch Funds:	$ 84,744
All Funds:	$792,117
FTE's:	2.4

Extension

Smith-Lever Funds:	$ 57,468
All Funds:	$128,095
FTE's:	1.2

Goal 2

Key Themes: Food Quality
Food Safety

Activity: 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. UVM researchers sought to determine if ultrasound represents an effective alternative to traditional processing treatment to reduce pathogen levels in heat-sensitive consumer products, such as milk and apple cider, without causing major compositional and structural changes. Several experiments were carried out using the laboratory to assess the effect of various ultrasonic treatments on reducing populations of *Listeria monocytogenes* and *Escherichia coli* O157:H7 inoculated into milk and apple cider to investigate the impact of ultrasound treatment on microbiological properties of raw milk and apple cider; on component interactions in milk; and to evaluate the effects of ultrasound treatment on the appearance and taste of milk and apple cider, using a trained panel.

Impact: Results show that ultrasonic treatment coupled with mild heating is a promising alternative method for milk treatment and apple cider pasteurization to preserve nutrients while maintaining color and flavor. Continuous flow ultrasound treatment, when combined with mild heat (57 degrees Centigrade), for 18 minutes resulted in a 99.999% reduction of *L. monocytogenes* in milk, 99.999% reduction in total aerobic bacteria in raw milk, and a 99.999% reduction in *E. coli* 0157:H7 in apple cider. Microstructural analysis revealed reduction of fat globule size as well as protein lipid interactions, which may be favorable.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

Goal 2

Key Themes: Food Quality
Foodborne Pathogen Protection

Activity: Processing plants developing food safety programs to combat microbial contamination desired help in developing systems which would allow them to either begin retailing products or to meet regulatory compliance guidelines.

Impact:

- UVM Extension helped a client to develop a HACCP plan enabling them to begin producing chicken pot pies for retail, as they were not currently operating under HACCP guidelines.
- A second client needed assistance meeting compliance levels for allowable pathogenic bacteria in a raw product. This company was helped via numerous site visits and in developing and validating a new system of testing their product. Furthermore, the company was aided in developing new processing methods which would cut down on the possibility of cross-contamination of products.
- A letter received from a large Addison County company indicated that assistance from the UVM Extension representative had enabled them to remain in business. The company representative noted that they received high quality assistance from UVM Extension in developing and implementing new policies sufficient to satisfy the Federal USDA inspectors and to assure that substantial ground had been made in addressing the issue. Furthermore, the company indicated that they had actually been able to save money on the testing of their validation activities as a result of a revised testing procedure that was suggested.

Sources of Federal Funds: Smith Lever 3 (b) & (c)

Scope of Impact: State Specific

Goal 2

Key Themes: Food Accessibility and Affordability

Activity: The number of people being served at emergency food sites continues to grow despite the fact that emergency food does not provide low-income Vermonters with a sense of security about their future food resources. It appears that many people are eligible for food stamps who are not participating. A food stamp outreach Web site (www.vermontfoodhelp.com) was developed to reach underserved Vermonters with information that might open the door to their participation in the Food Stamp Program.

Impact: Of the 919 households using the site to apply for food stamps over a one-year period, 82% were approved for participation in the Food Stamp Program, thereby providing assistance to approximately 1,820 people residing in these households. Of the total number of applicant households, 22% had an elderly or disabled person residing, 69% were households with children, 46% were households with earnings, and 4% were households with non-citizens. A total of 2,218 people resided in applicant households. The www.vermontfoodhelp.com Web site was an extremely successful way to reach out to Vermonters who were potentially eligible for the Food Stamp Program who had not yet applied for assistance through traditional means. Diverse populations used the site and were approved for program participation. The program provides greater food security for the 753 households with a representative who used the Web site, applied to the Food Stamp Program, and received food stamp aid approval. Additionally, greater numbers of people using food stamps reverberates throughout the food system, translating into economic benefit for food retailers, as well as others in the food production, processing, and marketing chain.

Sources of Federal Funds: Smith Lever 3 (b) & (c)

Scope of Impact: State Specific

National Goal Area 3

Overview: Currently 53% of adult Vermonters, or 226,615 adults, are overweight, and national childhood obesity rates have increased from eleven to 15% during the past decade. 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. UVM Extension has developed outreach programs reaching more than 2,500 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 is changing how institutions view healthy food pyramids, and the kinds of drinks offered to youth at school meals and in vending machines. VT-AES research has also developed a successful means of using the Internet to help overweight people to lose weight and to maintain weight once it is lost.

There will be 211,240 new cases of breast cancer diagnosed during the year 2005, and 40,410 deaths from the disease. Breast cancer studies are limited by the quality and control researchers have for their models to test therapies. UVM research on animal mammary form and function has led to the discovery that pigs are morphologically similar to humans, potentially providing a breakthrough animal system for developing breast and other cancer cures.

In Vermont, an estimated 7.7% of households lacked access to nutritious, safe, acceptable, and affordable food supplies between 1996 and 1998. 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. For these reasons, 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 improve food security through outreach. The Senior Farm Share program showed that 98% of participants plan to continue using recipes provided and tasted, and to eat a variety of vegetables daily. They are appreciative of the farm shares they receive, and this also helps farmers and seniors in building a community fabric through mutual assistance. Additionally, each year UVM outreach programs provide more than 1,000 pounds of additional produce for local food shelve through Plant-A-Row and other outreach programs targeting youths. 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. EFNEP assisted 214 adults and 1,081 youths to improve food resource management and nutrition practices, with 89% of children eating a greater variety of fruits and vegetables. EFNEP education outreach is improving the health of participating families, as families consume more nutritious, home-prepared meals. National data shows that each dollar invested in EFNEP saves $10.64 in future health costs.

Goal 3

Allocated Resources

Research:

Hatch Funds:	$111,395
All Funds:	$645,355
FTE's:	.7

Extension

Smith-Lever Funds:	$ 123,442
All Funds:	$ 275,148
FTE's:	2.6

Goal 3

Key Themes: Human Nutrition

Activity: Sugar intake by U.S. children has reached an all-time high, primarily due to increasing soft drink consumption. Soft drinks are displacing milk in children's diets resulting in low calcium intakes. There is a paucity of data examining the impact of added sugars intake on the overall quality of U.S. children's diets. UVM researchers used the 1994-96 and 1998 USDA Continuing Survey of Food Intakes by Individuals (CSFII) to examine the diets of U.S. children ages 6-17 years who provided two full days of dietary data. The nationally representative sample (n=3,038) included children ages 6-11 years (n=1,913) and adolescents 12-17 (n=1,125). Food codes for sweetened foods and beverages were selected from the USDA Food Coding Scheme and categorized into five food and beverage categories. The Statistical Analysis System software program was used to recode and format the data for statistical analysis and the Survey Data Analysis System was used to apply sample weights and generate statistical procedures.

Impact: The consumption of sweetened dairy products was positively associated with calcium intakes. Consumption of presweetened cereals increased the likelihood of the children meeting recommendations for the essential shortfall micronutrients calcium, folate, and iron while the consumption of sugar-sweetened beverages, sugars and sweets, and sweetened grains decreased the likelihood of meeting the Daily Recommended Intake (DRI) for these nutrients. Only children who were nonconsumers of sugar-sweetened beverages had a mean calcium intake that met the standard. Consumption of sweetened dairy products and presweetened cereals was positively associated with the number of dairy servings consumed per day. The results suggest that intakes of sweetened dairy foods and beverages and presweetened cereals had a positive impact on children's diet quality, while sugar-sweetened beverages, sugars and sweets, and sweetened grains had a negative impact on children's diet quality.

This research influenced federal nutrition policies, specifically the Dietary Guidelines for Americans and the USDA MyPyramid, regarding the amount and form of added sugars that should be recommended in U.S. children's diets. As a result of accomplishments in the nutrition arena, UVM will contribute leadership and food systems expertise to the FSLI curriculum through collaboration between colleges and departments, with representatives from the College of Agriculture and Life Sciences, Continuing Education, College of Education and Social Services, Nutrition and Food and Food Sciences, and UVM Extension joining in the effort. While Ohio and North Carolina will represent more of the production aspects related to food systems, Vermont will be bringing the local approach to food systems to the table to insure that the future leaders within the land-grant system understand and incorporate into curricula the importance of local agriculture to human nutrition and health.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

Goal 3

Key Themes: Human Health

Activity: Internet-based weight-loss programs appear promising in the short-term but to date, have not been able to produce the level of weight loss seen in traditional in-person treatment; thus, novel approaches are necessary. Using a combination of interactive technology and in-person support has been beneficial in other areas of medicine. The aim of this study was to compare 12-month weight loss outcomes of an Internet-only behavioral weight-loss treatment versus the same program, supplemented with monthly in-person meetings. One hundred and twenty-three participants were randomized to an Internet-only (n=62) or an Internet + In-person treatment (n=61). All subjects then participated in a 12-month behavioral weight-loss program conducted over the Internet. The groups met online weekly for the first 6 months and bi-weekly for the second half of the intervention. The I+IPS group had access to the same Web site as the I group but, once a month, attended an in-person meeting in place of an online chat. Assessments included body weight, program adherence and social support measures.

Impact: At six months, the Internet-only (I) group lost more weight than the Internet + In-person (I+IPS) group, although the difference was not statistically significant (-9.2 ± 7.0 kg vs. -6.9 ± 4.2 kg; p=0.08). On average, those in the Internet-only group lost 8 kilograms during the first six months of the study, while I+IPS participants lost 5.6 kilograms over the same period. These results are similar to those of costly in-person-only interventions. The trend toward a greater loss among the Internet-only group was less significant at 12 months (-8.0 ± 7.5 kg vs. -5.6 ± 5.5 kg, for I and I+IPS; p= 0.10, respectively). Supplementation of an Internet weight-loss treatment with monthly in-person meetings did not result in greater weight losses over 12 months. Dynamic, socially supportive, and interactive elements of the Web site may have obviated the need for further interpersonal behavioral counseling.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

Goal 3

Key Themes: Human Health

Activity: Fruit and vegetable consumption of many Americans, including seniors, is below the recommendations in the Dietary Guidelines for Americans. Low-income Vermont seniors lack access to fresh produce due to their limited resources. Extension teamed with the Northeast Organic Farmers' Association of Vermont through a Community Food Project Grant. Approximately 700 Vermont seniors received fresh produce each week during the summer of 2005 as part of the Senior Farm Share program that links CSA farms to seniors living in low-income housing sites. In the Northwest Region, Extension representatives presented nutrition education to six low-income senior housing sites reaching approximately 100 participants.

Impact: Many of the 100 senior participants had a chronic disease and were aware that eating fruits and vegetables is important for their health. However, many were unsure of the reasons for this, of ways to prepare uncommon vegetables (e.g., kale, Swiss chard, winter squash, and raw spinach), or were unwilling to purchase fresh vegetables since they felt these items cost too much. Topics included information on appropriate use of the food pyramid (MyPyramid), the importance of daily vegetable consumption, new ways to prepare various vegetables, and how to properly store and clean vegetables. Of the 75 seniors who responded to post-class evaluations, 95% indicated that they plan to continue using recipes provided and tasted, and to eat a variety of vegetables daily.

Sources of Federal Funds: Smith-Lever 3(b) & 3(c), USDA-CFP

Scope of Impact: State Specific

Goal 3

Key Themes: Human Nutrition

Activity: Expanded Food and Nutrition Education Program (EFNEP)—Although American diets in general are not meeting the recommended dietary guidelines, the average diet quality of limited resource families is even lower than the general population. Limited-income urban families and those living in isolated communities have a high risk of receiving inadequate nutrition. For 37 years, EFNEP, as an integral part of UVM Extension, made practical nutrition education accessible to limited-income families with children, providing them with the opportunity to acquire knowledge, skills, and changes in behavior to achieve adequate diets providing normal nutrition. Data collected during the 2005 fiscal year show EFNEP utilized 132 adult volunteers and seven youth volunteers to reach 214 adults and 1,081 youths.

Impact: 81% of families showed improvement in one or more food resource management practices and in one or more nutrition practices, and 61% showed improvement in one or more food safety practices. In addition, the following behavioral changes were reported from 138 families surveyed:

- 89% of children are eating a greater variety of fruits and vegetables variety of foods
- 53% are using the "Nutrition Facts" on food labels to make healthy food choices
- 31% are eating breakfast more often
- 47% are planning meals in advance
- 36% are comparing prices when shopping
- 46% are using lists when they grocery shop
- 37% fewer families are running out of food by month's end

One obese, homeless, unemployed young man with a substance abuse problem was referred to the EFNEP program after being hospitalized while trying to lose weight on a "crash diet." Efforts focused on assisting him in developing affordable, healthier eating plans and habits by taking him shopping to find healthy foods he could prepare in his hotel microwave oven and teaching him cooking methods using healthier recipes. In three months, he lost thirty-eight pounds and started increasing his activity level. Six months later and over 60 pounds lighter he was given medical permission to start a part-time job, and has since found an apartment to rent. Upon entering the program he was despondent and lacked feelings of self-worth. This October, he was invited to be a guest speaker at an annual coalition of agencies community meeting and he "wowed us all" with his sincere thankfulness for the support he received. "I was introduced to many support programs during this past year but instead of feeling degradation," he stated, "I met some wonderful and caring people who made me again feel like I am a worthwhile human being."

Sometimes, words of success take time to hear. Eight years ago, a woman enrolled in the EFNEP program as a pregnant seventeen-year-old high school drop-out living with her husband in a very rural area, and with no transportation at her disposal. After finishing the program, she delivered a healthy eight pound son and moved to California to be near family. She had telephoned to share that she had just graduated from college with a degree in nutrition sciences, and is returning for her Master's degree. During the call, made eight years after her participation in the program, she

said, “thank you for lighting that spark for me with your enthusiasm and the fun we had learning good eating habits and great cooking techniques. I never forgot your visits and the things you taught me and I know I want to do the same for others.”

EFNEP education outreach is improving the health of participating families, as families consume more nutritious, home-prepared meals. National data shows that each dollar invested in EFNEP saves $10.64 in future health costs.

Sources of Federal Funds: Smith-Lever (d)

Scope of Impact: State Specific

Goal 3

Key Themes: Human Health

Activity: Animal models are critical to understanding and curing human cancer. Studies of mammary gland and lactation processes in animals has led a UVM researcher to an important finding—pigs may be the best human substitute for studying drug, hormone, and other breast cancer therapies.

Impact: While heifers and sheep were studied, the pig showed the greatest similarities to the human breast. Recent research has unveiled that pigs have structural similarities in organs, tissues, and cells. The research shows that pigs are morphologically more similar to humans than the current popular alternatives, rodents, yet still represent a manageable animal system from a researcher's point of view. Studies continue to determine if function follows form—do pigs react biologically the same as humans? The research could open up a promising avenue for studying and curing breast cancer.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

National Goal Area 4

Overview: UVM Extension and VT-AES address problems associated with storm water runoff, which is contaminating streams, rivers, ponds, and lakes; affecting water quality, fishing and water sports qualities; causing summer beach closures that threaten the quality of life and tourism development; and affecting development plans around the state to meet higher water quality standards. High nutrient inputs on farmlands, businesses, and residential properties 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.

UVM researchers are developing useful visual tools that accurately estimate phosphorus losses occurring in watersheds and the impacts of farm land management changes to parts of a watershed. Researchers are also developing new technology and products that reduce the impact of commonly used and environmentally damaging products, such as road deicers, on water and soil quality. To add to this valuable enterprise, they are creating these products using farm by-products that would otherwise be a potential waste problem and cost for farmers, and create more damage to water or soils in their unprocessed form than they do as new products. Researchers are also studying how nutrient movement influences soil qualities in Vermont's forested lands.

Outreach specialists work within and between states to reduce negative impacts of boating on invasive species growth, and to assist residents and businesses in making choices that reduce contamination of waterways. Since 2002, UVM Extension has helped more than 1,500 middle school youth gain skills and knowledge about the water quality of waterways in their community, empowering students through the monitoring-based curriculum to communicate with town officials and the public about the quality of local waterways. This year, an additional 47 teachers spent three to five days learning locally-oriented watershed curricula designed for place-based education and at-risk youth populations. First use of the curricula with at-risk high school youth showed strong engagement levels among a typically academically apathetic student group.

Improving methods for agricultural 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 and transgenic crops on beneficial soil arthropods. VT-AES and UVM Extension have developed ways to reduced pesticide use by farmers and home gardeners while increasing profits for industries vulnerable to pest infestations, such as apple and greenhouse growers, and have shown that growers and consumers are utilizing this information to make behavioral choices to reduce the negative impacts farming can have on the environment. Researchers are also developing methods for eliminating reliance on fertilizers and reducing nutrient overloads to soils, by better understanding the mechanisms for naturally occurring soil fertilization.

Goal 4

Allocated Resources

Research:

Hatch Funds:	$ 276,485
All Funds:	$2,811,183
FTE's:	7.2

Extension

Smith-Lever Funds:	$ 206,205
All Funds:	$ 459,625
FTE's:	4.4

Goal 4

Key Themes: Water Quality

Activity: Decisionmakers lack useful visual tools that accurately estimate phosphorus losses occurring in watersheds and the impacts of farm land management changes to parts of a watershed. Accurate information could make environmentally sound farm practices more affordable for many farmers and produce greater improvements to watershed quality in shorter time periods. Research was conducted to combine Watershed Ecosystem Nutrient Dynamics (WEND) modeling with a Geographic Information System (GIS) to produce a decisionmaking tool that accurately estimates phosphorus (P) losses in a watershed under different management scenarios.

Impact: Researchers produced a tool, a Watershed Ecosystem Nutrient Dynamics (WEND) model, which is a simulation model of a complex watershed ecosystem in which people live, work, and play. WEND is the first water quality model used by NRCS programmed with STELLA. STELLA, which stands for Systems Thinking Experimental Laboratory, allows the user to graphically represent or "map" the natural system as a series of related inputs, outputs, and storages. When the "map" is defined in terms of mathematical relationships, the software develops the model equations or code. The watershed in WEND comprises forest lands, land in agriculture, and urban land areas devoted to commerce, industry, and habitation. The WEND model, constructed using the conceptual watershed ecosystem, links the models of the agriculture, forestry, and urban sectors. These linkages create an overall model that describes phosphorus storage and fluxes as an integrated whole system, that is, as a complex watershed ecosystem.

Sources of Federal Funds: Hatch, Smith Lever 3 (b) & (c)

Scope of Impact: Multi-state (CA, CO, IA, IN, MA, MD, ME, MI, MN, NE, NY, PA, SD, TX, VA, VT, WA)

Goal 4

Key Themes: Recycling
Water Quality
Soil Quality
Agricultural Waste Management
(NGA 1: Adding Value to Agricultural Products)

Activity: Chemical deicers (e.g., sodium chloride) are currently used in Vermont and other northern states to melt snow and ice for road safety during the winter. The chemical deicers have strong negative impacts on the environment, vegetation, water bodies, and roads. UVM researchers utilized the lactose in cheese whey, an agricultural by-product and waste problem for some cheesemakers, to develop an organic and environmentally safe and biodegradable snow and ice melting agent, potassium acetate, for winter road maintenance. To accomplish this, a free-cell coculture consisting of a homolactic bacterium (*Lactococcus lactis*) and a homoacetogen (*Clostridium formicoaceticum*) was used to convert whey lactose to lactic acid and then to acetic acid (AA) in a bioreactor. The fermented product was evaporated and spray-dried to formulate dry form products. The deicing performance of the organic deicer was tested both in the laboratory and on the roads.

Impact: Results from tests demonstrate that it is feasible to produce an environment-friendly substitute deicer (potassium acetate) from an agricultural byproduct—cheese whey. Successful development and application of the alternative deicer to replace sodium chloride for road maintenance will be beneficial to the dairy industry, transportation systems, and the environment. Further studies will consider the feasibility of scaling up for industrial production.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

Goal 4

Key Themes: Water Quality

Activity: Researchers conducted a Hazardous Area Critical Control Points (HACCP) bait workshop with 15 bait dealers, suppliers, and shops in collaboration with New York Sea Grant, Vermont Fish and Wildlife Service, and U.S. Fish and Wildlife Service. The workshop was designed to increase awareness of invasive fish species in out-of-state bait shipments coming into the Lake Champlain basin.

Impact: Post-workshop evaluation showed that all attendees found the workshop to be useful or very useful. As a result of attending, six public and private fish culture/transport entities are in the process of developing HACCP plans.

Sources of Federal Funds: Smith Lever 3 (b) & (c)

Scope of Impact: Multi-state (NY, VT)

Goal 4

Key Themes: Water Quality

Activity: 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.

Impact: This year, in addition to coordinating more than 40 watershed education and monitoring sessions with more than 500 students covering 40 streams and waterways within 11 watersheds of Vermont, the Watershed Alliance strengthened watershed education programming in the State by focusing on teacher education. Outcomes include the following:

- Approximately 85% of all students reported increasing knowledge and skills on watershed and water quality topics.
- Monitoring information has been made available to the public through an online database.
- An online 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 two place-based workshops for educators. The first workshop was a three-day event titled "Watersheds Interactive: Exploring the Watersheds in Which We Live." The second workshop was a two-day event titled "River Dynamics: Chemical and Physical Properties of Rivers." Forty-seven teachers participated. All participants reported gains in learning teaching tools they could use with students, and all planned to use the curricula in their classes in the coming year.
- Watershed education curricula were tailored 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.

The workshops were reported by teachers to be an excellent way to build a cadre of teachers in the state who are proficient in watershed education.

Sources of Federal Funds: Smith-lever 3(b) & (c)

Scope of Impact: Multi-state (NY, VT)

Goal 4

Key Themes: Soil Quality

Activity: Excess nitrogen (N) deposition has been targeted as a major environmental problem, especially in the northeastern United States. Concerns over the long-term deposition of N on forested ecosystems are increasing as some forested watersheds have begun exporting higher levels of nitrate. Stream water nitrate has been shown to originate from the soil nitrification process, so factors which influence or control soil nitrification rates (NR) are of interest in understanding watershed N export. UVM researchers examined small, forested watersheds in the northeastern U.S. to investigate the relationship of topographic, vegetative, and soil controls with soil nitrification rates.

Researchers examined temporal and spatial variation in inorganic N concentrations and in disturbed net transformation rates by establishing a sampling grid in each of four watersheds, and intensively sampled small plots within each to examine temporal variability. Soils were characterized in each sampling location to assess spatial patterns of soil properties. Plot-scale metrics were developed to characterize spatial patterns of vegetation and topography at sampling locations. Researchers used soil, vegetation, and topographic metrics to develop statistical models that explain spatial and temporal patterns of nitrogen dynamics.

Impact: Soil properties such as higher soil moisture, higher pH, and lower C:N ratios were most often correlated with higher NR. Topographic analyses indicate lower slope positions and higher elevations to be occasionally correlated with higher NR, possibly because of greater C and N accumulation and higher soil moisture contents. The C:N ratio and vegetation composition can explain differences between watersheds in terms of NR. Conifers were often associated with lower NR and higher C:N ratios while sugar maples dominated in areas of higher NR and lower C:N ratios. Soil properties were more often correlated with soil nitrification rates than were topographic properties. When conifers make up more than 50% basal area in study plots, NR was lower ($p < 0.0001$) and C:N ratios higher ($p < 0.0001$) when compared to plots dominated by sugar maple, yellow birch, or American beech. Results demonstrate the difficulty of finding similar controls on NR between watersheds, but do point to a regionwide influence of the C:N ratio and vegetation on soil nitrification rates.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

Goal 4

Key Themes: Biological Control
Soil Quality
(NGA 1: Plant Genomics)

Activity: While transgenic crops are being developed and planted regionwide, studies are needed to assess potential impacts of these crops on beneficial soil organisms. UVM researchers investigated the effects of selected microbial pesticides and transgenic corn on Collembola and other soil arthropods which are essential components of a healthy soil biota. In laboratory and field tests, entomopathogenic and antagonistic fungi and bacteria used in crop protection (e.g., *Beauveria bassiana*, *Metarhizium anisopliae*, *Bacillus thuringiensis*, and *Trichoderma harzianum*) were presented to two species of Collembola using a novel feeding assay. Effects on survival, longevity, and fecundity were determined. Effects of transgenic (Bt) corn (root toxins and crop residues) on diversity and abundance of Collembola and other microarthropods was determined by season-long sampling of soils planted with transgenic and non-transgenic corn. Microarthropods were extracted by Berlese funnels, and species diversity and abundance compared over three cropping cycles, from pre-planting through post-harvest. Finally, the stability of the Bt toxin during composting (two composting systems were tested) and silage fermentation was determined and effects of the composted material on Collembola evaluated. Toxin stability during these processes is not well documented; break-down of the toxin will avoid any potential "downstream" side-effects on non-target organisms.

Impact: These trials were devised to allow us to identify potential risks associated with novel crop protection technologies. Results suggest that microbial biopesticides and Bt transgenes will have minimal impact on non-target soil dwelling species such as Collembola and carabid beetles.

No adverse effects were observed when Collembola were exposed to infective conidia derived from entomopathogenic and antagonistic fungi, or their metabolites, some of which are insecticidal. Similarly, no adverse effects were observed when Collembola were fed on Bt spores and toxin crystals, both lab-cultured and commercially formulated materials. These lab data demonstrate the apparent safety of these microbes for these microarthropods.

In a soil bioassay experiment, corn root powder from transgenic plants expressing the Cry1Ab toxin had no significant effect on population growth of *Folsomia candida*, compared to root powders derived from the isogenic line. In field trials, where persistent expression of the Bt toxin by all plant cells raises concerns over potential non-target impacts and accumulation in the environment, two silage corn varieties were planted, one expressing the Cry1Ab toxin and its isoline. Season-long monitoring of surface- and soil-dwelling Collembola and carabid beetles was done over two growing seasons. There was no significant treatment effect on surface-dwelling collembolan diversity and distribution in each year of the study; no species were associated specifically with one treatment over the other. For soil-dwelling Collembola, three dominant species were recovered from all treatment plots and years, and no treatment effect on diversity was detected. Four dominant species of carabids were recovered from all treatment plots, and there was no significant difference between treatments on species diversity and dispersal.

Results indicate that Bt-corn does not negatively impact either of these important groups of arthropods. This information is vital to decisionmaking processes for regulators and environmentalists when considering approval for the introduction and widespread utilization of these techniques in place of synthetic pesticides. Decisions relevant to the use of transgenic crops and insect pathogens need to be made considering effects of existing management strategies, generally chemical insecticides, which frequently have a more deleterious and broader ecological impact.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

Goal 4

Key Themes: Natural Resources Management

Activity: Invasive species are causing economic losses as well as altering ecosystem function. This project examined the traits responsible for invasiveness in an invasive grass, *Phalaris arundinacea*, by comparing individuals taken from known invasive and non-invasive populations. UVM researchers sampled thirty individuals taken from three populations of *Phalaris arundinacea* from two European (Czech Republic and France) and two North American (Vermont and North Carolina) locations. Individuals were grown in the greenhouse and allozyme analyses were run. Ninety distinct genotypes were identified. Isozyme analysis was conducted to identify distinct genotypes and to determine the distribution of genetic variation both within and between populations in Europe and the United States.

Impact: Isozyme analysis of the populations revealed that genetic mixing had occurred between populations in Czech Republic and France in the invasive range in Vermont and North Carolina. A common garden experiment done with 49 invasive and 41 native genotypes revealed that the invasive genotypes emerged faster, produced more leaves and shoots and had overall higher biomass. We have found that the invasive genotypes are more aggressive than the genotypes taken from the native range in Europe. This is important information for developing plans to prevent establishment of, and to reduce or eradicate invasive species.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

Goal 4

Key Themes: Integrated Pest Management

Activity: 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.

Impact: 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. Annual New England-wide conference and workshop survey results show these strategies are reaching growers, who are implementing them in high numbers. UVM outreach specialists conducted surveys of IPM research and outreach impact on growers and consumers.

First, researchers surveyed 135 growers and landscapers from Maine, New Hampshire, and Vermont who participated in a five-credit course covering greenhouse IPM strategies. Based on a 50% return rate on evaluations:

- All but one of the participants stated they learned new pest management techniques that they planned to implement during the coming year, including the use of habitat and banker plants (32 responses), sanitation and preventative control (10 responses), and using new plug production products (6 responses).
- Two-thirds of attendees are now using some form of integrated pest management, and have changed their management techniques in some way as a result of attending workshops. 44% changed their methods for monitoring plants for insect pests and diseases. 32% changed how they used information collected from scouting.
- Over 70% of growers used biological control in the past year. 59% used biological control as a preventative treatment before detecting a pest, 21% used them after detecting a low pest population, and 12% used them when a pest population was increasing.
- Over 40% of growers checked pH and EC levels in potting media and water more often, and adjusted levels accordingly.

As additional evidence that workshops are effective at educating and affecting change among participants, approximately 85% of school landscapers, 100% of apple growers, and half of all beginning farmers who attended customized IPM workshops stated that they learned information that will help them reduce their use of pesticides on their farms.

During the Summer of 2005, 224 customers at 8 Vermont garden centers and farm stands were surveyed to gain an understanding of consumer interests when purchasing bedding plants and ornamentals, and to assess their knowledge of IPM:

- Consumers educated about IPM indicate they are willing to pay between 10 and 20% more (70%), and would be willing to drive farther (40%) to purchase IPM-grown plants.

- More than 80% of consumers would be willing to purchase plants containing beneficial insects.

Based on results, University of Vermont has developed a colorful IPM poster and eye-catching brochure for distribution to growers and distributors across the state. It has since become so popular it was distributed throughout the Northeast. A consumer survey is planed for 2008 to gauge the purchasing effects of increased exposure to the public about IPM.

Sources of Federal Funds: Smith-lever 3(b) & (c)

Scope of Impact: Multi-state (ME, NH, VT)

Goal 4

Key Themes: Integrated Pest Management

Activity: Early detection of pests is the cornerstone of IPM, enabling growers to address pest problems when they are low and localized, which is ideal for biological control. UVM researchers are developing indicator plants for early detection of greenhouse pests. VT-AES researchers have assessed the effectiveness of two marigold varieties ('Lemon Gem' and 'Hero Yellow') and comparing them to sticky traps.

Impact: Data show that early in the season thrips were detected on the marigolds at least one week earlier than on the sticky traps. Detection using marigold declines over the season as other plants began to bloom. Other pests not typically detected using sticky traps, such as aphids and spider mites, were also detectable using the marigolds, possibly further enhancing their value as cost-effective, biological pest-monitoring tools. Trials will be repeated in 2006 to further determine the best use of certain marigold cultivars as trap crops.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

Goal 4

Key Themes: Integrated Pest Management

Activity: 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. UVM researchers seeking ways to improve thrips control using a variety of low environmental impact techniques need to better understand thrips activity patterns. UVM researchers documented daily thrips activity on spring budding plants.

Impact: Data from documents shows thrips larvae are more active in the evening on plants, while flight activity varied throughout the day. Trials will be repeated in 2006 to better define activity trends. This information can assist growers in timing of scouting and treatment for thrips. UVM is also developing whey-based waste formulae to improve the effectiveness of beneficial microbes for use against thrips. Several trials were run in two commercial greenhouses showing interest and involving themselves in the project. Results of the work were scheduled to be presented at the tri-state greenhouse IPM workshops held in January 2006, as well as at educational events. By developing more effective and safer control agents for thrips, and by timing their use to be most effective, thrips damage in greenhouses can be greatly limited.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

Goal 4

Key Themes: Soil Quality
Nutrient Management

Activity: Current approaches to controlling plant disease in agricultural settings involve 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 ecologically friendly alternatives to current integrated pest management strategies. UVM researchers examined a collection of 1,000 Arabidopsis lines containing randomly inserted T-DNA elements in an effort to identify plant genes that played a role in establishing the binding sites for *P. fluorescens* on the root surface. However no plant mutants were identified in this screen. Using an alternative approach, the researchers have generated transgenic plants expressing chimeric cell wall proteins in roots.

Impact: UVM researchers have shown that within two hours, *P. fluorescens* is capable of binding to Arabidopsis roots. The binding is established in a distinct pattern, with bacteria first adhering to the grooves between cells in the root and later binding to the epiderminal surfaces themselves. Expression of chimeric proteins in Aradopsis roots resulted in an increase in root hair branching and an alteration in cell wall structure. Analysis of transgenic lines such as these will define critical features of the root cell wall that establish a binding site for bacteria on the root surface and are important for the formation of biofilms. Understanding factors that are critical for the binding of beneficial bacterial to plant roots will make it easier to enhance plant nutrition and disease resistance for plants growing in native environments and/or in modern agricultural settings.

Sources of Federal Funds: Hatch

Scope of Impact: State Specific

National Goal Area 5

Overview: UVM Extension and VT-AES strive to develop community fabric and support networks using a variety of well-tested methods mixed with innovative ideas. Highly skilled facilitators have helped dozens of communities meet community and job improvement needs, and have helped community groups to raise more than $13 million to achieve community development goals. Entrepreneurship conferences, jobs coaches, and E-commerce innovations have served to bring jobs, funds, and new businesses to many rural Vermont communities. UVM Extension has been able to utilize technology as a means of improving communication and consensus among diverse community stakeholders over issues associated with tourism development by applying a “participatory systems modeling” approach.

Training to reduce the digital divide affecting rural communities has helped hundreds of youths and adults to use computers and Internet features to improve their lives. 4-H youth development programs, with 6,038 youth members, have been in the forefront of this effort, and this is increasing the number of youth joining new technology-embracing 4-H clubs. Improvements in communication among rurally located volunteer leaders, and between volunteer leaders and 4-H staff members has improved morale and reduced leader turnover. UVM Extension works to improve the lives of migrant worker families, and has served almost 700 eligible families to improve their educational experiences this past year.

Goal 5

Allocated Resources

Research:

Hatch Funds:	$ 221,157
All Funds:	$1,450,456
FTE's:	3.2

Extension

Smith-Lever Funds:	$ 818,332
All Funds:	$1,824,036
FTE's:	17.3

Goal 5

Key Themes: Community Development
Jobs/Employment

Activity: A partnership between UVM Extension and UVM's Center for Rural Studies has helped to create and develop resources and vehicles for information technology and innovations to assist local governments, small businesses, and entrepreneurs in decisionmaking and economic activities. In 2005, 125 local officials, citizens, and college students attended workshops and presentations on Vermont demographics, accessing Census data, using data in community planning, and other related topics, with 77 officials sent by communities to regional municipal Web site development and information safety seminars. In addition CRS fulfilled an estimated 360 special data requests that were phoned or e-mailed in.

Impact:

UVM's Center for Rural Studies subcontracted with the Vermont Council on Rural Development (VCRD) in order to support their work on community processes and coalitions for local broadband provision. The VCRD process, which facilitates local community-level solutions for broadband service, has served 47 Vermont towns, with at least 16 achieving full provision success. Ten more successes are expected in 2006.

The Center has produced a useful and more comprehensive "E-Commerce Toolkit for Agricultural Micro-Businesses" and useful community-oriented online data centers that provide rural communities with easy access to quality data for use in community and business decisionmaking. Examples include the following:

- Vermont Indicators Online (http://crs.uvm.edu/indicators) has been a popular mainstay of this program area and CRS has recently acted on feedback from users on the visual and geographical comparability features associated with the data available. Major upgrades and enhancements to the site were successfully deployed in early 2005. In 2005, this Web site enjoyed 10,000 user visits (26,000 hits).
- Vermont State Data Center Network – CRS is the U.S. Census Bureau's Vermont State Data Center (SDC). As the lead agency in the SDC program in Vermont, CRS is charged with supporting the access and use of Census data by citizens. In 2004, the Vermont SDC added the Business and Industry Data Network, increasing the number of organizations in our entire network to 37. This provides quite a comprehensive "net" for helping Vermonters use Census data. In 2005, there were more than 8,700 user visits (63,000 hits) to the SDC's online portal (http://crs.uvm.edu/census).
- Public GIS Portal for Libraries – CRS subcontracted with the Vermont Center for Geographic Information (VCGI) for the creation of a public GIS portal that would be accessible from local libraries, thus expanding graphic information resources available to residents. This project includes training for library and historical societies staff members on the use of the portal, guiding users, and adding locally-created data to the portal. In 2005, VCGI assembled a pilot demonstration site for this project which will be visited and evaluated by local library staff throughout Vermont.

- Vermont Housing Data (www.housingdata.org) – CRS collaborates with the Vermont Housing Finance Agency on the development and maintenance of this first-of-its-kind statewide housing data Web site.

One database user residing in a rural Vermont town stated, "Thank you for enabling me to get the correct information. I'm glad I noticed it. I use this Web site all the time to get information to show the need in grants. Little do you know that your Web site has helped in getting over $800,000 in grants just for one library. So, thank you for your diligence and having the Web site to begin with! Have a great day."

Sources of Federal Funds: Smith-lever 3(b) & (c)

Scope of Impact: State Specific

Goal 5

Key Themes: Community Development
Jobs/Employment

Activity: Collaboration between UVM Extension and UVM's Gund Institute of Ecological Economics has yielded an innovative tool for grappling with the sometimes overlapping and apparently conflicting economic, social, recreational, and ecological issues faced when considering local and regional tourism development goals. Researchers are piloting a "participatory computer modeling" approach to address tourism and recreation industry goals for six communities in three states located within the Northern Forest Bioregion of the United States. All six communities expressed interest in developing their tourism and recreation industries to strengthen their local economy. Participatory computer modeling was introduced as a tool to aid in community decisionmaking around the many issues related to recreation and tourism. In each community, fifteen to twenty-five stakeholders, representing areas ranging from inn and transport industries to recreation clubs to historic preservation representatives to residents gathered together for a day of discussion and model development. Researchers evaluated the experiences of these communities to determine the effectiveness of community-based model-building workshops as a tool for consensus- and community-building. Evaluation included graduate student observation and interpretation of workshop participation, participant evaluations (n=70), and interviews with researchers.

Impact: Results show that the participatory computer modeling was found to be a valuable process in bringing rural community members together and providing a forum for discussion of community issues in all six communities. The process was most valuable to 44% of participants in fostering an atmosphere for productive discussion and exchanging new ideas, while 22% felt its most valuable service was to introduce stakeholders to systems thinking. The tool provided an opportunity for discussion using a common language, which offered more opportunities for participants to seek and gain clarity from other speakers, and to improve cooperation among community members (17%). Possible limitations to the work include a lack of diversity among interested stakeholders (6%), and unmet expectations by participants for running models within the limits of time, energy, and stakeholder commitment (22%). While most community members evaluated their experiences positively, additional research is needed to determine if this is the most effective tool to use in rural communities.

Sources of Federal Funds: Smith-lever 3(b) & (c)

Scope of Impact: State Specific

Goal 5

Key Themes: Community Development
Jobs/Employment

Activity: Economically depressed rural communities have challenges to improve their economies while preserving their community fabric and values. After town officials met with UVM outreach personnel in the year 2000 to discuss ways of improving the local economy, talks led to the creation of the Alburg Farmer's Market. Over the next five years, the tiny start-up market grew to become a thriving Champlain Islands Farmer's Market with about 25 vendors at two locations—in Alburg and in South Hero, which was added in the summer of 2005.

Impact: While the impact of the farmer's market on the Alburg economy has been challenging to measure, it has been an economic boost for some 25 local farmers and artisans who can make $200 on a Saturday from the roughly 100 people who stop between 9 a.m. to noon. Vendors sell vegetables, flowers, meats, cheese, eggs, arts and crafts, baked goods, and handmade products such as handbags. Early indications from South Hero are that the spin-off will grow into a major farmer's market. A record 292 people stopped at the new location in just three hours one past summer day. "They've almost tripled the number of vendors between the two markets," says Dan Baker, UVM lecturer. "They support each other, but they are two different markets. South Hero appears to be very strong and was prime for this kind of thing. Alburg is a lower-income area and the growth has been slower, but the victory is that it has maintained a steady market and showed the depths of its community support."

Like many family farm owners, Joanne James is constantly looking for ways to diversify not only what she sells, but also where she sells it. Operating out of the small Champlain Islands town of Alburg in the northwest corner of the state, she sells her cheese, meat and vegetables on her Web site (Lakes End Cheeses, www.lakesendcheeses.com), at a retail outlet, and at area stores. "There was a real need for something like this here," says James, past president and current treasurer of the market. "You're getting retail prices rather than wholesale, which is about 50 % more without the middleman. I'm not sure we would have survived early on as a fledgling market without the support of UVM."

Some of the original seed money to start the market came from a Vermont Integrated Research and Extension Competitive Awards grant. The Alburg Revitalization Committee donated money it received from the Vermont Sustainable Jobs Fund and partnered with the American Legion, which donated space to host the market under a new three-season structure with a roofed area. UVM specialists strongly encourage smaller communities to forge as many partnerships as possible and utilize all local resources when trying to spur economic development. The University helped facilitate some of these partnerships, but prefers to act in more of a support role. Faculty, staff and students offer help with marketing, advertising, planning, writing bylaws, and conducting surveys to find ways to improve the market.

Student interns help set up for vendors each week, count receipts, collect data, and administer programs like the Vermont Farm to Family program that allows families enrolled in WIC to redeem coupons for fresh vegetables and fruit at farmers markets. "I'm from Minneapolis so I

hadn’t really been exposed to rural farm communities and how they work,” one intern says. “This experience has really given me a chance to see the challenges these communities face and how they work together to overcome them.” The other intern, who used to sell products as a vendor at another farmer’s market, says the experience has opened her eyes to all that goes into setting up a market each week and keeping it running. “We do a lot of planning, but you never know what’s going to come up. In a real-life setting with a lot of people involved things come up that you don’t always anticipate. We’ve had to learn how to make things work by dealing whatever comes up each week. I’ve really enjoyed it,” she says.

Sources of Federal Funds: Hatch, Smith-lever 3(b) & (c)

Scope of Impact: State Specific

Goal 5

Key Themes: Community Development
Jobs/Employment

Activity: 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 apply this philosophy to work with rural communities in need of community development action plans.

Impact: Since the program inception in 1992, more than fifteen participating communities have moved from initiation through implementation to create significant positive changes, as a result of work initiated through a Take Charge/Recharge approach to decisionmaking and action planning. These communities have been able to leverage more than $13,000,000 in support of community projects. Examples include:

- Working with a collaborative of organizations, including UVM Extension, Northern Community Investment Corporation was able to secure a $200,000 grant to be used to lend money to start-up businesses in the creative economy sector of rural towns.
- The Brighton Community Forum received a USDA Rural Development Grant of $80,000 to complete their funding package for construction of their Welcome Center.
- In September, the VT Mountain Arts Group opened an Artist Gallery in Newport to support and sell local artwork.
- After more than a decade of careful planning and more than $4,000,000 raised through committed fundraising efforts, Indoor Recreation Orleans County (IROC), a committed group formed after a 1993 Take Charge program, officially opened its multi-million dollar recreational center in a rural Vermont town.
- Orleans and Essex counties received a $10,000 grant to develop an economic plan, which has since been written and accepted by the VT Vocational Rehabilitation program for implementation.
- A Recharge program led to the formation of the Brighton Community Forum, which has secured $285,000 in funding to build a Welcome Center for the community.
- One rural community created a recreation committee that raised over $70,000 in two years and completed construction of a town playground.
- 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.”

- One Take Charge program, in a rural county badly affected by economic woes associated with job losses due to company moves, was attended by over 75 residents. 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. More than twenty start-up businesses have been assisted through the program in its first year of operation.
- 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.”

Sources of Federal Funds: Hatch, Smith-lever 3(b) & (c)

Scope of Impact: State Specific

Goal 5

Key Themes: Community Development
Youth Development

Activity: For over 100 years, the University of Vermont 4-H program has been teaching youth leadership, citizenship and life skills, operating in all fourteen counties in Vermont through a variety of well-tested delivery modes. All programs are based on learning-by-doing approaches that allow youth to experience mastery in subject matter, a sense of belonging to a group, a sense of generosity to those around them, and a sense of independence, with opportunities to take on leadership and make important decisions. UVM Extension, as the home of 4-H, works on many levels to cultivate healthy communities. Visit www.uvm.edu/extension for more information.

Impact: Vermont 4-H served 6,038 youth in 325 community clubs. Two-thirds of participants live in towns with fewer than 10,000 people, and an additional 12% live on farms, reflecting the rural and small-town audiences primarily served. Over half of all youth served live in racially and ethnically mixed communities. While these numbers are smaller than previous year's numbers, this difference is primarily a reflection of changes made in calculating membership. During 2004, Vermont 4-H made the decision to no longer manage and maintain liability on several camps that had begun as 4-H projects years earlier, and 2005 was the first year in which camp-goers were not included in membership numbers. A much needed database cleanup has made reporting of membership numbers more accurate, and this is reflected in 2005 membership totals, as well. UVM 4-H participants were served by 909 adult and 89 youth volunteers during FY 2005. Volunteers were primarily female (approximately a 4 to 1 ratio of female to male volunteers).

The most common areas of interest for 4-H community-based clubs were horse and pony (16%); dairy cattle, edible gardens, and arts and crafts (8%); and community service, foods and nutrition, and shooting sports (2 to 3% each). Vermont 4-H is serving a growing area of interest – technology, as participation increased from less than one to 3% of all 4-H members in just one year. To meet this growing demand, Vermont 4-H has sought and obtained funding to support several technology-based club activities and initiatives:

4-H Science and Technology Development

University of Vermont Extension partnered with Vermont Associates for Training and Development to fund a Vermont TechCorps (AmeriCorps) member to commit 900 hours to serve as a mentor in computer and Internet basics for a rural Vermont community. During the year, the TechCorps member recruited, trained, and mentored thirteen school and library volunteers for program sustainability. A 4-H after-school technology club was formed, where children learned skills through a CyberCamp program (http://gocybercamp.org) and practiced skills through a community mapping project. Ten children received the "TechKids" designation and became the core for developing additional youth technology activities within the school.

At the public library, the TechCorps member and the librarian conducted adult education computer classes, recruiting senior citizens who came to that location for senior meals three days

a week. This program ran for 20 weeks and library volunteers have continued the program after the TechCorps member completed serving. Additional work with the community helped 13 seniors gain their first computer skills, with one senior going on to becoming an enthusiastic EBay participant.

Enviroquest camps also emphasized science and technology skill development with 372 middle-school youths at 13 rural schools, covering topics such as light and lighting, aerospace, weather and climate, and space geology. 14% of students self-categorized themselves as racial minority or racially mixed. Based on results using the Washington Life Skills Evaluation tool, 75% of students showed gains in developing useful and marketable skills, leadership skills, communication skills, using resources wisely, and decisionmaking skills.

UVM Extension was also awarded a Geographic Information Systems (GIS) software grant from USDA-CSREES and ESRI to assist middle school youth in eight communities in the design and construction of comprehensive maps pinpointing critical issues in their towns. Maps were to be presented to town and county officials, and the public as useful problem-solving and decisionmaking tools, while also learning important technological skills and local environmental and cultural history. Working with community partners (hydro-energy company TransCanada, owners of Lake Whitingham) and GIS professional mentors, youth created a recreational use map for the lake distributed at its picnic areas. In 1924, the building of the Harriman Dam and the creation of Lake Whitingham had profound economic, environmental, and social impact over thousands of local acres and hundreds of lives. About 40 farms and the town of Mountain Mills were lost when the land was flooded. This event is virtually unknown to students and their parents, not yet born at the time. As a second phase of the community mapping project, the students are planning to identify, locate, document and showcase the town that was Mountain Mills using research methodologies such as interviewing, data collection and archival research with state-of-the-art technologies, such as the Internet and GIS. When finished, students will present their work to Whitingham residents so that the community can draw strength from their rich cultural tradition and appreciate their heritage.

Assisting Vermont Military Families

Vermont 4-H personnel and participants also found ways to assist Vermont military families during a year of high deployment rates. During 2005, Vermont 4-H children sent care packages with toys, writing supplies, and handwritten letters expressing their care and concern, to over 1,600 children of deployed National Guard families living in Vermont. The National Military Family Association (NMFA) chose University of Vermont 4-H and Greater Burlington YMCA to host a popular Operation Purple Summer Camp in 2006. The camp provides free opportunities for children ages 9-14 from military families and whose parents are or recently were deployed. It provides typical summer camp activities, such as swimming, boating, and sports, while also assisting children in coping with the array of challenges they face as children of deployed military parents and guardians.

Youth Record-Keeping Skill Development

4-H member record books provide stories that show more than 80% of participants have gained life skills and can express these through pictures and words. One member wrote, “I am proud of my determination in 4-H as well as how far I’ve improved from being an immature 6-year-old, to who I am now. I think 4-H has helped improve my life and school career because of components like writing and reflecting in record books as well as keeping records, planning and organizing.”

This year we had several 4-H “graduates” go on to attend college at the University of New Hampshire in the pre-vet program. One young woman noted that the knowledge and skills she gained as a 4-H member helped her to make an exciting career choice. When she first joined 4-H she was very shy, lacked self-confidence and had poor communication skills. With the help of a nurturing 4-H club, this young lady has gone on to compete in all state horse program contests, in Eastern States, and the National Horse Round-up in Louisville, Kentucky. From a very shy individual to a confident, academically accomplished college freshman strongly involved in community service, this young woman represents the essence of youth development achieved through participation in Vermont’s 4-H program.

Sources of Federal Funds: Smith-lever 3(b) & (c)

Scope of Impact: State Specific

Goal 5

Key Themes: Community Development
Youth Development

Activity: Migrant families often suffer from poor and inconsistent educational experiences, thereby reducing their opportunities for improving the quality of their lives, and the future lives of their children. Language barriers can limit access to available services. Multilingual UVM Extension personnel in the Vermont Migrant Education Program (VMEP) worked with the Department of Education to identify and recruit migrant workers within Vermont, and to assist enrollees in succeeding at their student experiences.

Impact: This year personnel were able to enroll 684 new migratory agricultural students. During the course of the academic school year the VMEP served 400 or 58% of these eligible students. During the course of the summer the VMEP served another 217 of these 684 students. In Vermont 74% of eligible students are dairy farm laborers or the children of dairy farm laborers. The remaining eligible students are from seasonal logging families, and fruit and vegetable harvesting families. Currently 35% of the student population is Hispanic, whereas Hispanic migrant workers represented just 1% of the eligible population in 2001. In 2001 there were no Hispanic children under the age of 6, and now there are 25 such children. Two-thirds of the population are school aged children and services provided by the VMEP are supplemental educational services ranging from homework help, in-school tutoring, English language lessons, after-school program funding, transportation to and from after-school programming, summer school sessions, summer camp programming, free books, pre-school support, home visits, and literacy base activities for families in their home. One third of eligible individuals are “Out-of-School Youth (OSY)—people under the age of 22 who do not attend school. The VMEP serves these individuals with English Language classes, and Spanish literature.

Sources of Federal Funds: Smith-lever 3(b) & (c)

Scope of Impact: State Specific

B. Stakeholder Input Process

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.

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.

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.

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.

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. 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. 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.

Food Safety and Health program personnel receive input from many stakeholder groups, including UVM faculty from the department of Nutrition and Food Sciences; UVM Center for Sustainable Agriculture; 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; Vermont Agency of Agriculture, Food, and Markets; Vermont Department of Aging and Independent Living; Southwest Council on Aging; Vermont Restaurant Association; 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.

UVM Extension consults 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 include 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 decisionmaking. The advisory council meets twice a year, receives informational mailings and telephone calls, and additionally, using e-mail technology, participates on a Community and Economic Development listserv. 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.

C. Program Review Process

There have been no significant changes in the merit review or scientific peer review process since the FY 2004 report.

D. Evaluation of the Success of Multi and Joint Activities

As part of the national land-grant system, UVM Extension and VT-AES 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. Federal and state funding supported more than twenty multi-state and integrated programs conducted by UVM Extension and VT-AES. By combining resources and personnel effort with other institutions, planned programs exceeded expected outcomes and impacts for the period, and program effectiveness and efficiencies were improved.

E. Multi-state Extension Activities

National Cold-Climate Viticulture Support and Research

Outreach and research are helping early adopters of cold-climate winegrape growing. Working with other states, Vermont outreach and research experts have helped approximately twelve vineyards to become active in Vermont, and more are in the planning stage, with between 30 and 40 acres of grapes in the ground at this time. Data collected on after-winter bud survival, yield per vine, average cluster size, average berry size, soluble solids content, and pH of targeted grape cultivars are currently being statistically analyzed to further assist growers in the state and beyond. As new information emerges on appropriate growing cultivars for various microclimates, results are posted on a public Cold Climate Viticulture Web page. Additionally, an in-depth assessment of grape berry moth and leafhopper infestation, as part of an IPM system, has been conducted at each existing vineyard and results were communicated to growers. A regional workshop for cold-climate grape management reached 32 people, and others had to be turned away due to space limitations. The result has been improved canopy management, which has positive impact on fruit quality, disease reduction, and cold hardiness. Growers have used information from the workshop to solve problems related to overly vigorous vines. Growers have used pest assessments in their IPM programs for making decisions about management. The Vermont grape growers' database has been updated to include new growers in 2005 and includes profiles of the emerging wine grape industry in Vermont, pinpointing areas of priority for research and technology transfer, such as cultivar performance and cold hardiness in Vermont, the development of an IPM program for grapes in Vermont, and cultural practices for cold-climate grape-growing. The University of Vermont Cold Climate Viticulture Web page http://pss.uvm.edu/grape/ is now available to current and prospective grape growers in Vermont and the region, and contains a primer on integrated pest management, links to newsletters, and growing season observations from the field. Research progress and outreach success have led to UVM's selection as a participant in a nation-wide grape cultivar adaptability study.

Penn Vermont CropMD Software Development and Application

UVM research and outreach specialists have been collaborating with Penn State University to update software (CropMD) 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.

National Watershed Ecosystem Nutrient Dynamics (WEND) model

Research was conducted to combine Watershed Ecosystem Nutrient Dynamics (WEND) modeling with a Geographic Information System (GIS) to produce a decisionmaking tool that accurately estimates phosphorus (P) losses in a watershed under different management scenarios. UVM researchers worked with researches from several other states around the country to produce a simulation model of a complex watershed ecosystem in which people live, work, and play. WEND is the first water quality model used by NRCS programmed with STELLA, which stands for Systems Thinking Experimental Laboratory, and allows the user to graphically represent or “map” the natural system as a series of related inputs, outputs, and storages. When the “map” is defined in terms of mathematical relationships, the software develops the model equations or code. The watershed in WEND comprises forest lands, land in agriculture, and urban land areas devoted to commerce, industry, and habitation. The WEND model, constructed using the conceptual watershed ecosystem, links the models of the agriculture, forestry, and urban sectors. These linkages create an overall model that describes phosphorus storage and fluxes as an integrated whole system, that is, as a complex watershed ecosystem.

Lake Champlain Water Quality Improvement

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 and for waters feeding Lake Champlain, shared by New York and Vermont. 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 in Vermont 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 New York researchers, to develop baseline and longitudinal data on Lake Champlain water quality indices.

New England Integrated Pest Management for Greenhouse Growers

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. Annual New England-wide conference results show these strategies are reaching growers who are implementing them in high numbers.

Vermont/New Hampshire Farm Business Education

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.

Women's Agricultural Network

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). UVM hosted a national WAgN conference this year, which received wildly positive reviews from attendees. This coming year, a national emphasis to the program exists, as CSREES plans to be involved in hosting the annual conference.

National Children, Youth, and Families at Risk Program

Working with a Kentucky-based CYFAR liaison, and people from Iowa, Arizona, and Penn State, several projects have been initiated and expanded as part of an umbrella to Expand Caring Communities and Engage Youth in Communities. The second funding period began in mid-2002 and has so far achieved the following impacts:

- more than $150,000 in-kind and cash match provided by community organizations, agencies, service groups, and government;
- more than 25 site project programs initiated/expanded;
- more than 20 programs involving or led by volunteers;
- 49 community organizations, agencies, service groups and/or government officials are working in collaboration with the site projects;
- more than 1,000 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), 85% of those reached indicate behavioral change has occurred in one or more of 8 life skills evaluated; and
- more than 200 youth have been reached with 50 or more contact hours.

F. Integrated Research and Extension Activities

Cold Climate Viticulture Start-Up Success

Integrated projects have helped UVM Extension and VT-AES to assist early-adopters of cold-climate viticulture in northern New England. Outreach has helped to develop twelve active Vermont vineyards covering approximately forty acres, and with the potential of producing 100,000 bottles of wine annually. Research on post-winter bud survival has provided useful data for winegrape growers, as data shows differences in vine yields between cultivars and microclimates, and results are posted on the Cold Climate Viticulture Web page (http://pss.uvm.edu/grape/). Research progress and outreach success have led to UVM's selection as a participant in a nationwide grape cultivar adaptability study.

Farm Financial Management Skill Development

Over the past two years, integrated programs under the Farm Viability Enhancement Program have provided business planning/technical assistance to 98 dairy and diversified farmer applicants, representing 31,500 farmland acres, 40 of whom completed full business plans. All participants completed enterprise budgets, refined book-keeping practices, or were referred to farm transfer planning, Extension's Dairy Profitability Enhancement Program, Land Link Vermont, NxLevel business planning classes, or market assessment services. Workshops and approximately 60 farm visits over the past 3 years have yielded more than 20 successful farm transfers, representing approximately 1,800 acres of farmland.

Soil Management Skills Development

Forty farmers participated in the "Dirt on Soils" research and outreach program, with a waiting list required. All of the 30 participants surveyed reported increases in knowledge of soils. Follow-up evaluations showed that 75% of the farmers made changes in soil management to increase soil health. Changes on these farms included reducing compaction, adding more organic matter to soils, and increasing crop diversity. Year-long mentoring added value for participants, and all mentored participants made at least two major changes to their soil management practices. Most participants noted how the course radically altered their way of thinking and approaching soil management on their farms which have direct economic, environmental, and social benefits for them as farmers. Program design has enabled UVM Extension outreach professionals to maintain contact with over half of the original course participants. The continuous learning process has enabled farmers to continue making progress and is allowing UVM Extension to monitor longitudinal impacts of an educational program.

Geospatial Watershed Nutrient Dynamics Tool Development

Research was conducted to combine Watershed Ecosystem Nutrient Dynamics (WEND) modeling with a Geographic Information System (GIS) to produce a decisionmaking tool that accurately estimates phosphorus (P) losses in a watershed under different management scenarios.

Alternative Farm Energy Exploration

To address changing energy and information needs for farmers, UVM hosted a forum on Alternative Farm Energy that brought in 79 farmer, educator, and agency participants, and 95% of those surveyed stated that the forum improved their understanding of alternative energy options, gave them appropriate ideas of areas for further exploration, and provided them with resources or people they will contact at a later date. More than two-thirds of participants stated they planned to make an energy-related change in their farming operation as a result of attending the forum.

Local Market Development and Research

UVM Extension and research are assisting economically depressed rural communities to improve their economies while preserving their community fabric and values. After Alburg town officials met with UVM outreach personnel in the year 2000 to discuss ways of improving the local economy, talks led to the creation of the Alburg Farmer's Market. Over the next five years, the tiny start-up market grew to become a thriving Champlain Islands Farmer's Market with about 25 vendors at two locations—Alburg and South Hero, which was added in the summer of 2005. Observation and data collection is conducted with the help of UVM interns. The farmer's market has been a boost for approximately 25 local farmers and artisans who sell vegetables, flowers, meats, cheese, eggs, arts and crafts, baked goods and handmade products, and who can make an average of $200 on Saturdays during the season from the roughly 100 people who shop there. A record 292 people stopped at the new location in just three hours one past summer day. "They've almost tripled the number of vendors between the two markets," says Dan Baker, UVM lecturer. "They support each other, but they are two different markets. South Hero appears to be very strong and was prime for this kind of thing. Alburg is a lower-income area and the growth has been slower, but the victory is that it has maintained a steady market and showed the depths of its community support."

Facilitating Community-based Community Development

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 apply this philosophy to work with rural communities in need of community development action plans. Measuring impact for long-term programs requiring long-term commitments can be difficult. Case studies have assisted in accumulating data about program successes and gaps. More than fifteen 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 decisionmaking and action planning. These communities have been able to leverage more than $13,000,000 in support of community projects.

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Actual Expenditures of Federal Funding for Multistate Extension and Integrated Activities
(Attach Brief Summaries)
Fiscal Year: 2005

Select One: □ **Interim** **X Final**
Institution: University of Vermont
State: Vermont

	Integrated Activities (Hatch)		**Multistate Extension Activities (Smith-Lever)**		**Integrated Activities (Smith-Lever)**
Established Target %		**%**		**%**	
This FY Allocation (from 1088)					
This FY Target Amount					
Title of Planned Program Activity					
National Goal Area 1	$279,243		$307,046		$530,132
National Goal Area 2	0		20,194		45,763
National Goal Area 3	0		16,078		86,129
National Goal Area 4	194,087		152,659		396,071
National Goal Area 5	197,139		120,122		279,898
Total	$670,469		$616,099		$1,337,993
Carryover	0		$0		0

Certification: I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays represented here accurately reflect allowable expenditures of Federal funds only in satisfying AREERA requirements.

Director **Date**