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# Certification of Vermont Annual Report of Accomplishments and Results (FY 2006)

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**Annual Report of Accomplishments and Results  
FY2006**

<b>Table of Contents</b>	<b>Page Number</b>
Executive Summary	3
Section A. Planned Programs	
Goal 1: An agricultural system highly competitive in the global economy	6
Goal 2: A safe and secure food and fiber system	43
Goal 3: A healthy, well-nourished population	55
Goal 4: Greater harmony between agriculture and the environment	65
Goal 5: Enhanced economic opportunity and quality of life	88
Section B. Stakeholder Input Process	105
Section C. Program Review Process	107
Section D. Evaluation of the Success of Multi-Institutional and Joint Activities	109
Section E. Multistate Extension Activities	109
Section F. Integrated Research and Extension Activities	117
Fiscal Year 2006 Expenditures	122
Revised Fiscal Year 2005 Expenditures	123

## Executive Summary

The Vermont Agricultural Experiment Station (VT-AES) was established in 1886 to advance scientific research to serve Vermont's rural and agricultural needs. Since its founding in 1912, University of Vermont (UVM) Extension has worked to translate researched-based conclusions into information that Vermonters can use. Given Vermont's predominantly rural population, Extension concentrates on research that helps rural residents, farmers, gardeners, forest and land stewards, and underserved rural communities improve business profitability, economics, nutrition, food safety, and youth and adult life-skills development, and that helps all Vermonters to improve water quality and ecological health of Vermont's treasured natural resources.

UVM was added in 2006 to the prestigious Carnegie Foundation's list of institutions meeting their "Community Engagement" classification, becoming one of just 76 such institutions in the nation. UVM gained the unusual distinction of qualifying and being listed for its work in both curricular engagement (service-learning classes and community-based research, for example) and outreach and partnerships (extension activities, community service programs, continuing education, etc.) that show strong alignment with university and state mission, culture, leadership, resources and practices. The Carnegie Classification of Institutions of Higher Education continues to be used for a wide range of purposes by academic researchers, institutional personnel, policymakers and others.

UVM Extension also produces and hosts the longest-running daily commercial television spot in Extension history, *Across the Fence*, which latest polls say reaches 25,000 households. An FY2006 Vermonter Poll showed that over 81 percent of those interviewed knew about *Across the Fence*, and 90 percent of those respondents watched the show several times per year or more.

This past year, VT-AES and UVM Extension made approximately 81,000 direct contacts to 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. Newer projects target younger audiences, with health, technology, and life-skills development initiatives reaching pre-school populations, increasing the youth population directly reached through programs to over 18,000 youths. Another underserved audience includes children of migrant workers, who UVM Extension assists in obtaining placement and services that improve student success in Vermont schools, with nearly 30 percent of this population representing ethnic minorities. VT-AES conducted 177 research programs during FY2006, with approximately half of these Hatch-funded, and with most additional projects leveraged, at least in part, as a result of previous Hatch-funded research. UVM Extension and VT-AES combined talent to conduct 17 projects directly integrating research and outreach, and 25 multistate outreach and research projects were conducted.

Farming initiatives include assisting farmers to deal with rising energy costs through the development and use of on-farm biofuels. Researchers and outreach specialists are also tackling costly animal health problems, such as mastitis through a better understanding and modification of genetic, biochemical, and behavioral pathways. One invention provides altered genes, which allow expression of active protein in desired mammalian cells or tissues, creating a low-cost

mechanism for eliminating mastitis in dairy cows.

Agricultural industry is rapidly changing, and business management has helped more than 1,500 of Vermont's farmers, and new and aspiring farmers to meet the challenges of the changing environment through outreach and linking projects, and through the development of new agricultural niches, such as cold-hardy vineyard and cheesemaking operations. Vermont is a national leader in the domestic artisan cheese industry; with more artisan cheesemakers per capita than any other state, a growing collection of awards from national and international groups like the American Cheese Society and a high profile in the national media. UVM recently launched the Institute for Artisan Cheese -- the first organization in the country dedicated to providing professional education, research, technical, food safety and marketing support to makers of hand-crafted cheese.

In addition to assisting agricultural industries, VT-AES and UVM EXTENSION work to ensure the safety and health of all consumers, with a new emphasis on youth food handling. Highly interactive, on-line software has been developed by UVM EXTENSION and is being tested nationally with 500 students to ensure its effectiveness in meeting middle school student needs regarding safe food processing, handling, cooking, and storage. Additionally food handling safety classes have been expanded to reach care facilities with preschool-aged children, with a success rate demanding expansion to additional facilities. Each year, between 150 and 200 youth and young adults participate in food safety classes, with 90 percent passing tests providing them with food service credentials, and recent classes are targeting people entering the school food industry.

UVM is dedicated to helping people avoid the complications of obesity through innovative and successful weight loss, weight-loss maintenance, and fitness strategies with populations in Vermont and nationwide, by developing and utilizing a vast array of Internet communications technology and resources, and by making programs user-friendly enough that they are accessible to nearly all individuals with access to a computer. Outreach specialists also focus efforts on ensuring safe and convenient access to healthy foods for low-income populations through programs such as EFNEP, reaching 175 individuals, with nearly all showing positive changes in behavior, and most in multiple areas of making healthier choices that provide them with more stable, healthy diets throughout each month, and 4-H Growing Connections, targeting more than 300 children and older youths, which showed improvement in life skills, gardening skills, cooking and food preparation skills, good safety skills, and strong relationship-building and teamwork skills. Career-oriented gardening programs for older-aged youth and young adults conducted by UVM demonstrate this same outcome set and pattern, indicating how successful agricultural activities can be to developing other life skills for youth and young adults.

UVM researchers and outreach specialists have made exciting breakthroughs in assisting populations in reducing negative impacts on the environment by working with farmers to develop their own nutrient management plans, that comply with all regulations, and which are faithfully adhered to, and even exceeded by farmers who share ownership in their development; and by developing and patenting new technologies that reduce the environmental impact of reducing populations of damaging agricultural pests, such as a whey-based, low environmental-impact, fungal microfactory technology sprayed on trees to kill the hemlock woolly adelgid, an

exotic pest that is wiping out native trees from Tennessee to Massachusetts. Researchers have also developed a successful agricultural phosphorus removal system that works efficiently, effectively, has minimum land needs, can handle a large diversity of phosphorus concentrations, and is easily combined with existing drainage and treatment systems. In addition, the system provides a long term solution for phosphorus removal via regeneration of the EAF iron slag, and used slag has the potential to be re-used as a fertilizer or a soil amendment in acid contaminated waste sites. Education and outreach to neighborhoods, businesses and school youth have shown measurable reductions in phosphorus loading of Lake Champlain and positive youth and college student outcomes regarding academic engagement and career advancement. This past year, a ten-year survey of UVM's Integrated Pest Management outreach work was evaluated, showing great successes in changing behaviors of commercial and home gardeners in reducing negative impacts on the environment while maintaining profits and improving quality of life indices. Additionally, the Consultative Group on International Agricultural Research (CGIAR) announced that the University of Vermont is the recipient of its Innovation Marketplace award and a \$30,000 prize, a competitive program supported by the World Bank, USAID, and other organizations, for UVM's ten-year achievements to manage Sunn pest, a damaging insect that limits production of wheat, a staple essential to feed hungry people in arid agricultural areas of the world, through timely detection and the use of insect-killing fungi as a biological control.

Youth and rural families are addressed through a variety of programs in all National Goal Areas by UVM faculty and staff. Certain programs specifically target youth and/ or community development, with documented success. UVM Extension's 4-H club program has improved life skills this past year for over 2,000 youth, with many new initiatives in science and technology skills development, and gains in school collaboration occurring through the increase in after-school programs initiated, and the positive feedback received from students and teachers, alike. A Business Coach program has infused entrepreneurial growth in rural areas, adding 25 new employees to small companies, and assisting 67 new clients in 31 communities. Expansion of e-Commerce Toolkits and education outreach is further serving the entrepreneurial spirit of Vermont, as well as work being accomplished to assist towns, using innovative systems-thinking communication tools, in developing cost-efficient strategies for attracting tourism that matches community values and infrastructural capacities. Website and personnel changes have helped UVM to increase enrollment in the Migrant Education Program, improve the process for schools by reducing error rates in families referred to schools to 1.6 percent, and thereby increasing the ability for schools to provide resources for the 81 eligible students enrolled this past year.

UVM Extension and VT-AES feel invigorated through the success of this past year to initiate new, and expand existing projects to meet the needs of Vermonters. Multistate collaborations have led to improvements in program development; integration between research and outreach, and between program areas and disciplines; and successful patent developments that permit additional outreach for research innovations. A multistate effort created a new on-line logic-model-based, data collection and reporting tool that staff and faculty find friendly, and that administrators, faculty and staff find more helpful and straightforward in providing feedback needed for communicating with the many Vermont and out-of-state constituencies having a stake in the short and long-term strategies and programs planned and implemented by UVM staff and faculty.

## A. Planned Programs

### National Goal Area 1

**Overview:** During FY 2006 UVM Extension and VT-AES efforts and resources were further integrated to improve the health, profitability, and sustainability of Vermont's diverse agriculture, while enhancing linkages to healthy communities and the natural environment. UVM Extension and VT-AES contributed 21.3 FTEs, or 33 percent of total effort, toward National Goal Area 1, budgeting a total of \$3,563,145 in federal and state funds toward projects in this area. During FY2006, VT-AES initiated or continued more than 70 research projects, and UVM Extension made an estimate of 676,300 total contacts, with 22,834 direct contacts. An estimated 3.1 percent represented ethnic minorities and 5.9% of direct contacts represented youth. UVM Extension targets underserved groups, such as rural agricultural workers and women. UVM Extension worked with 858 volunteers, who contributed 10,004 hours of their time toward programming in NGA 1.

During FY2005 and 2006 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 led by ten agricultural specialists, among them some of the nation's top animal scientists includes projects designed to:

- quantify the direct and indirect effects of antibiotic-based control programs targeting subclinical mastitis;
- evaluate the effectiveness of treating subclinical mastitis in lactation as a way of reducing disease incidence;
- examine dairy breed differences in the immune response to *E. coli* mastitis;
- determine if production of new antibacterial enzymes in the mammary gland can protect against mastitis;
- identify the factors that contribute to the severity of coliform mastitis;
- examine the regulation of gene activity in mammary cells in response to infection;
- determine the mechanisms of hormone regulation in bovine mammary gland development; and
- study the role of sugar uptake in bovine tissues in supporting milk production.

Maple syrup production represents a significant portion of income for more than 2,000 Vermont landowners, offers part-time employment for thousands of individuals each spring, and provides for full-time employment for many Vermont retailers, packers, and equipment manufacturers. UVM Extension received overwhelmingly positive results from a ten-year survey conducted to assess the impacts of research and outreach efforts for maple syrup producers, a majority of whom claim the program has helped them to improve their maple sugaring operations (85 percent), improved their sugarbush management practices (85 percent), improve tapping practices (75 percent) and implement newer maple production technology (71 percent). UVM Extension works within and between New England states to bring the latest research to the industry and the public.

- Research utilizing long-term records of maple sugaring supports research showing global warming trends.

- A North American Maple Syrup Council sponsored project was established at the UVM's Proctor Maple Research Center (PMRC) to examine differential timing of tapping and the effects of tapping date on total sap yield;
- Research on how sap collection methods affect sap yields will help sugarmakers determine when retubing a sugarbush is economically viable;
- Research and outreach on a long-term project examining the effects of weather and tree physiology on sap pressure and flow, shows how air temperature relates to wood temperatures in various parts of the tree, which are critical in determining sap flow, and data are presented live via the PMRC Website TREEMET, an electronic monitoring program that includes real-time display.

Vermont has been a leader in developing cold-hardy wine grapes. Research and 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, representing about 100,000 bottles of wine annually. Research progress and outreach success have led to UVM's selection as a participant in a nation-wide grape cultivar adaptability study. Seven other projects also test USDA Zone 3 and 4 hardiness during changing climactic conditions and explore options that may help growers and home gardeners as researchers and outreach specialists:

- develop strategies for composting home and garden waste;
- evaluate cold hardiness of herbaceous perennials;
- assess economics of New England horticulture industry;
- assess American and hybrid elms for resistance to fungal disease and insect pests;
- evaluate the effectiveness of different mulches as a top-dressing to control growth of weeds; and
- evaluate sugar maples grafted onto sycamore maple rootstock for salt tolerance in urban environments.

UVM Extension is assisting interested farmers in developing alternative and renewable sources of on-farm energy, in the face of rising fuel prices, including biofuels, made from vegetable oil, alcohol, and lye. The Sustainable Agriculture Council in Vermont is supporting these efforts as well focusing on research into farm-scale alternative energy production, use of waste oils, and co-generation (electricity and heat production) from bio-gas.

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 website focusing on biosecurity issues as a means of disseminating this information to the public (<http://www.uvm.edu/~ascibios/>).

Organic food is the fastest growing segment of agricultural sales in the United States, increasing by approximately 20 percent 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 more than 7,000 acres of Vermont farmland. This represents a 35 percent growth in certified organic acreage since 1999. Vermont and Maine researchers and farmers tested whether organic milk producers, with organic milk receiving significantly more money than for conventionally

produced milk, are actually increasing profits for Vermont organic dairy farmers. Research results, showing limited success for organic milk producers over the past five years, have been widely publicized, including on national television news and talk-show broadcasts.

Agricultural profit margins remain slim in Vermont and in combination with volatile sales receipts, make 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, interdisciplinary partnerships with multiple state and regional partners, UVM Extension has funded the Vermont Farm Viability Program, which has helped 112 farmers overseeing a combined total of 45,600 farm acres to make long-term farming and management decisions. Eighty 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 quadrupling 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 having successfully transferred the farm to a future generation.

UVM Extension also works with Vermont and Maine to support farm families affected by a disability to be productive and successful. Vermont reached 177 clients in FY2006, and 95 percent reported satisfaction rate with their current employment, whereas many vocational rehabilitation programs find new employment options do not meet client expectations.

## **Goal 1**

### **Budgeted Resources**

#### Research:

Hatch Funds:	\$ 626,271
All Funds:	\$1,895,917
FTE's:	11.5

#### Extension

Smith-Lever Funds:	\$ 437,769
All Funds:	\$1,667,228
FTE's:	9.8

## Goal 1

**Key Theme:** Agricultural Profitability  
Animal Health  
Animal Genomics

**Issue:** 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 percent of dairy cows will experience a course of mastitis during their annual lactation cycle. The estimated cost of this disease to the US dairy industry is nearly \$2 billion per year. Current therapies and preventative treatments for staphylococcal mastitis rely heavily on sterilization techniques, selective culling of animals with chronic recurring mastitis, and the use of antibiotics. There has been little success with vaccines, and sterilization techniques have less than a 15 percent success rate.

**Activities:** 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.

UVM researchers also made progress in isolating and reproducing a microbial enzyme that may prove deadly to *Streptococcus uberis*, a pathogen that causes some 25 percent of all bovine mastitis cases in the U.S. Work continues to determine if this new enzyme is of sufficient potency to warrant further investigation.

UVM researchers have invented a mechanism to provide altered genes, in which the naturally-occurring microbial sequences have been engineered to allow expression of active protein in desired mammalian cells or tissues. An altered gene has been modified in such a manner that the protein it encodes is not only produced in mammalian cells, but is secreted from those cells, so that a local concentration of anti-staphylococcal protein is created outside of the cells. Genes have also been altered so that the anti-microbial protein is expressed within cells that are sensitive to intracellular infection.

**Impact:** UVM researchers successfully collaborated with researchers at USDA/ ARS in Beltsville Maryland to produce transgenic cows with enhanced mastitis resistance. The transgenic cows produce the anti-staphylococcal enzyme, lysostaphin, in their milk and are highly resistant to mastitis caused by *S. aureus*.

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. This work and its widely published findings demonstrate the feasibility of a transgenic approach to improving animal health and reducing dairy farmer costs.

The gene-altering mechanism invented provides a genetic approach to eliminate mastitis, currently costing the dairy industry \$1.7 billion per year in reduced milk yield, reduced compositional quality, lower product quality, and increased veterinary cost.

**Sources for Federal Funds:** Hatch, USDA-National Research Initiative

**Scope of Impact:** State Specific

## Goal 1

**Key Theme:** Agricultural Profitability  
Animal Health

**Issue:** Healthier dairy calves grow more efficiently, more economically, and have the potential for greater milk production as cows. Enteric disease is the leading cause of death in pre-weaned calves. Almost 50 percent of deaths before weaning are related to enteric disease. By reducing calf mortality through better nutrition, the profitability of dairy farms will improve.

**Activities:** UVM research and outreach personnel have conducted several studies to investigate nutritional strategies to reduce illness and death in young calves and to support future milk production and herd profitability. Last year researchers began to investigate the long-term effects of varying the amount of milk replacer fed to neonatal calves on their future milk producing ability. Thirty calves were enrolled in the study, the first cohort due to calve beginning in December 2006. A master's thesis completed in 2006 described their early growth and metabolic changes, showing clear differences in early growth seen between the calves fed a milk replacer containing 20 percent crude protein and 20 percent crude fat and those fed a higher protein milk replacer at higher levels. No differences were seen in early growth, health, or metabolic measures among calves fed milk replacer, containing 26 percent crude protein and 18 percent crude fat, according to four different feeding protocols. In a second study, researchers found no differences in growth, but found a trend in earlier peak immunoglobulin levels in calves fed four grams of lactoferrin with their first feeding. Further studies will be conducted to elucidate the relationship between passively acquired immunity (from colostrum) and immune function in calves.

Two calf manager training workshops highlighted the importance of neonatal calf management in conventional and organic production systems. UVM Extension personnel presented "Colostrum--Don't Be Born Without It" to a Sustainable Livestock Conference audience. By facilitating the Annual Vermont Dairy Industry Association and Vermont Feed Dealers' Association conference attended by 150 producers, industry, extension, and consulting personnel, Extension was able to produce proceedings and a widely viewed PowerPoint presentation aimed at improving farmer and specialist understanding of neonatal calf immune status and best management practices to promote health.

**Success Stories:** To quote attendees:

"Really appreciated the organic info."

"Program was very thorough and I particularly found info[rmation] on disinfecting useful."

An e-mail quote from a farmer recently purchasing a farm, stated, "The cows are so much more comfortable and happy. They came up in milk on the very first shipment, even after the stress of moving. You've had a big role in getting us to this point."

**Sources for Federal Funds:** Hatch and Smith-Lever (b) & (c)

**Scope of Impact:** State Specific

## Goal 1

**Key Theme:** Agricultural Profitability

**Issue:** Efficient milk production is crucial to the economic success of dairy farmers and reduces the environmental impact of dairying. The purpose of this project is to optimize milking frequency during early lactation to enhance milk yield.

**Activities:** UVM researchers used a unilateral frequent milking protocol to demonstrate that effects of frequent milking during days one to twenty-one of lactation are localized to the mammary gland. Milk yield responses are significant and persist throughout the lactation. Other milking intervals did not give as great a response. We also found associated changes in expression of specific genes in mammary gland.

**Impact:** These results, published in six peer-reviewed articles, indicate that frequent milking during the first 21 days of lactation is an effective management tool for increasing milk production efficiency. The estimated economic value is nearly \$300 per cow per lactation. UVM Extension personnel are sharing research findings with farmers to assist them in implementing milking management strategies that will increase farm profitability and reduce environmental impacts. Both of these outcomes are crucial to the viability of Vermont's dairy farms. Future work will investigate the effects of extra milking only one hour after the standard milking to determine applicability of the method on small herds. Other studies will seek to determine changes in gene expression in order to identify the biological mechanisms involved in the milk yield response.

**Sources for Federal Funds:** Hatch

**Scope of Impact:** State Specific

## Goal 1

**Key Theme:**            **Agricultural Profitability**  
                                 **Diversified/ Alternative Agriculture**

**Issue:** Cold climate wine grape production is an emerging new crop in Vermont and the region offering exciting value-added and agri-tourism economic opportunities. A key challenge to this young industry is the selection of wine grape cultivars which will consistently produce high quality fruit under our variable environmental conditions. High quality fruit is the basis for quality wine production. The cost associated with planting one hectare of grapes (approximately \$12,000 to \$20,000), makes it critical for growers to plant cultivars that will survive Vermont winters, perform consistently well, and produce outstanding fruit and wine that offer the consumer a high-quality product and the grower economic success. No testing of the adaptability, productivity, and fruit and wine quality has been conducted in Northern New England, where climate is the major limitation for the successful establishment of many cultivars.

**Activities:** Work in FY2006 included:

- establishing protocol to evaluate cold-hardy winegrape cultivars in association with multistate project, NE1020 “Multistate Evaluation of Winegrape Cultivars and Clones”;
- collecting data on bud survivorship after winter low temperatures of selected cultivars at the cooperating vineyards in 2005;
- updating the Vermont grape growers database created in 2004, to include new growers;
- further developing the University of Vermont Cold Climate Grape Production web page, <http://pss.uvm.edu/grap/>, (contains a primer on integrated pest management; links to eleven newsletters showing high-quality photos of specific diseases, insects, and physiological conditions affecting wine grape cultivars, and growing season observations from the field; links to web pages of industry resources; university and extension information regarding grape production; and weekly accumulation of growing degree days from various locations in Vermont);
- summarizing research data on horticultural performance of select wine grape cultivars at four commercial vineyards;
- conducting an in-depth assessment of grape berry moth and leafhopper infestation, as part of an IPM system; and
- organizing and conducting a vineyard tour/workshop for 60 individuals with discussion of factors that impact grape production.

**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. In addition to the French hybrid varieties dominating production, cold-hardy clones of vinifera varieties like Riesling and Zweigelt are also in the ground, with results pending.

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. 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:** Integrated -- Hatch, Smith Lever 3 (b) & (c)

**Scope of Impact:** Multistate -- CA, CO, IA, IN, MA, MD, ME, MI, MN, NE, NY, PA, SD, TX, VA, VT, WA

## Goal 1

**Key Theme:** Agricultural Profitability  
Diversified/ Alternative Agriculture

**Issue:** The concept for the South Hero Land Trust (SHLT) Farm Initiative resulted from a research project investigating ways a local entity like South Hero Land Trust could play a greater role in promoting agricultural viability at the local level. Over the course of 2005, the land trust used a combination of interviews with local farmers and food distributors (restaurants and local groceries), and a consumer survey to see where the challenges and opportunities lie in promoting local agriculture. Using results from this research, the concept for the SHLT Farm Initiative came into being with the goal of partnering with farmers and the community on projects that advance agricultural viability by attempting to: 1)integrate consumers, producers and food distributors, thereby creating a stronger local agricultural economy; 2)increase public awareness of the processes involved in various types of agriculture production; 3)draw more people to the Champlain Islands Farmers' Market, thereby increasing sales potential and creating stronger connections between producers and consumers; 4)provide a forum for local producers and community members to guide future farm initiative projects; and 5)provide increased exposure for farms not represented at the Champlain Islands Farmers Market

**Activities:** South Hero Land Trust (SHLT) worked with UVM Vermont Tourism Data Center and Center for Rural Studies, while utilizing 2006 SARE Sustainable Community Grant funds to promote the viability of agriculture in South Hero and the Lake Champlain Islands. Through the South Hero Land Trust Farm Initiative, the organization: 1) created the "Champlain Islands Grown" Guide to Agriculture featuring area farms and distributors of local agricultural products, 2) developed a Champlain Islands Farmers' Market Education Program consisting of six educational "theme" days at the market, and 3) formed the SHLT Farm Initiative Steering Committee comprised of consumers, producers, and food distributors who help guide the course of the SHLT Farm Initiative. These efforts create stronger linkages between the various entities that comprise our local agricultural system and raise awareness of the critically important role agriculture plays in the community.

**Impact:** Projects of the South Hero Land Trust Farm Initiative have reached a wide spectrum of farmers, consumers, and local food distributors. In total, the "Champlain Islands Grown" Guide to Agriculture includes 44 agricultural producers from all five Grand Isle County towns and eight restaurants and markets offering locally grown food. For the first year of a county-wide guide, these results met the goal of including a majority of farms, with 61 percent of 72 producers contacted deciding to be listed. Even farms that did not participate (since they only provide produce for a coop) thought that the guide was a good idea. Nearly 3,000 guides were distributed through over thirty businesses and information centers in two counties.

To assess the guide's effectiveness at linking producers and consumers, a survey was mailed in the fall of 2006 to all businesses listed in the guide. Response rate was 43 percent of producers (19 out of 44). Responses show that 79 percent responded that the guide increased exposure to their business; 72 percent believed that being published increased their sales; 100 percent believed the guide increased their awareness as consumers of local agricultural products; 33

percent would pay to be included in future editions of the guide (with 56 percent stating “maybe” they would pay), with a median value of \$25 and a mean of \$30 for the amount they would be willing to pay; 75 percent stated they would be interested in advertising or sponsoring future guide editions, with some suggesting future editions include putting the guide on the internet and widening distribution.

University of Vermont personnel gathered data from consumers of the Champlain Islands Farmers Market on the agricultural guide and educational events at the market. When asked if they owned a copy of the agricultural guide, 38 percent of those surveyed replied “yes.” Of customers who own a copy of the guide, 52 percent believed the guide led to an increase in purchases of local goods. With respect to farmers market events, approximately one-third of the respondents knew about the theme day before arriving, which considered to be a “reasonably high percentage for a new promotional effort.” Over half of all respondents visited the theme area, of which 83 percent felt that the presentations and activities effectively conveyed the theme of the day. One of the most inspiring theme days was the Youth Market with 14 young vendors. It was incredible to see the confidence boost these entrepreneurs received when people started buying their food and handmade items.

The Champlain Islands Farmers Market’s success over the course of the year is shown in the increase in attendance and overall gross receipts for 2006, at \$30,214, an increase of 15 percent over 2005 sales. The partnerships created through the Farm Initiative are also one of the major accomplishments of the past year. In addition to partnerships created with numerous farmers, the Farm Initiative resulted in collaborations with South Hero Community Library, Lake Champlain Basin Program, Vermont Master Gardener Program, Lake Champlain Islands Chamber of Commerce, Vermont Agency of Agriculture, and University of Vermont’s Department of Community Development and Applied Economics. Many local volunteers also helped out with events at the Champlain Islands Farmers Market.

South Hero Land Trust is utilizing information gathered from the agricultural guide to help promote farms interested in agri-tourism with a second guide. The Mad River Valley area of Vermont may use the guide as a model for a similar venture. Future efforts include increasing local foods in groceries, restaurants, and schools; and promoting dairy farms that sell bulk milk to cooperatives through activities such as value-added production, diversification, transition to organic, and farm tours.

**Sources of Federal Funds:** Hatch funds/ SARE

**Scope of Impact:** State-specific

## Goal 1

**Key Theme:** Agricultural Profitability  
Diversified/ Alternative Agriculture

**Issue:** The Rutland Area Farm and Food Link (RAFFL) is working with UVM and the Vermont Land Trust to improve a diverse and thriving agricultural industry in Rutland County, supported by the county's residents and communities. Among these efforts, is the coined "5-10-50-100" campaign, designed around the concept that within 5 years at least 10 percent of food purchased by Rutland County consumers will be produced within 50 miles of where they live, contributing toward the State's goal of adding \$100 million to the local economy via purchase of local agricultural products.

**Activities:** The major focus toward meeting objectives is the creation of a community farm and agricultural resource center -- a working farm that will provide a starting place for new farmers. By providing farm space and equipment for beginning farmers to rent, the focus is on building their markets, developing a strong business plan, and determining efficient and effective growing techniques. This will ensure that when people do make the transition to a farm of their own, they will be investing in an economically viable, pre-existing business. In addition, the Farm will be a learning space for the public to reconnect with agriculture and food production, and a resource center serving farmers from across the county. Activities also focus on expanding the local market for locally produced foods through buy-local publications, community dinners highlighting local foods and farms, and a branding campaign to help consumers identify food grown within the county.

Work has been done to:

- identify a property for the Farm based on a public visioning session to identify important components of the project that would direct the land search;
- create a Land Search Committee, with the help of the Vermont Land Trust, that met ten times to identify an outreach strategy, discuss potential properties and meet with interested land owners, and meet with the Rutland and Clarendon Planning Commissions to gain project support and identify town level farmers with an understanding of agricultural land in the area;
- co-host with the Rutland Town Selectboard a public informational meeting on the Farm to increase public awareness of the project and seek leads on potential farm properties;
- mail information on the Farm project and land characteristics to over 160 large land owners in Rutland Town and Clarendon Vermont;
- create GIS maps for six potential properties with soils and other property features;
- speak with 19 property owners and visit eight interested properties to determine appropriateness for project;
- begin process of working with identified farmer and property toward establishing Farm.

Outreach work to the consumer and farmer community through the 5-10-50-100 campaign includes:

- distributing 8,500 copies and promoting RAFFL’s first ever “Locally Grown Guide” for Rutland County, created over the spring of 2006 with the help of Green Mountain College students and professors;
- initiating a branding campaign for Rutland County Agriculture, with “Heart of Vermont Agriculture” stickers and informational signs mailed to 16 Rutland County Farmers and distributed at the Rutland, Poultney and Fair Haven Farmers Markets;
- promoting 5-10-50-100 challenge and other RAFFL activities on Lakes Region Radio Coffee Break talk show, through press releases, and news coverage in area newspapers;
- hosting "Building Community Through Local Food: a Harvest Celebration with Frances Moore Lappe" (in partnership with many other community organizations);
- hosting a large community meal of locally sourced products for close to 300 people, including farmers serving menu items (at the event, an additional 8 people signed up to receive RAFFL information, and over 20 people took the “Localvore Challenge” a commitment to eat entirely local foods for a day or a week in October);
- co-hosting, with Green Mountain College, the "2nd Annual Farmers Gathering", which attracted over 100 attendees to explore the challenges and opportunities for institutional purchasing of locally grown food through a discussion between interested farmers and producers, institutional buyers, distributors and consumers; and
- measuring the effectiveness of these activities through farmer and consumer surveying activities.

Over 450 working hours from board members, dedicated community members, and staff members of our partners have been leveraged through the work of RAFFL’s half time coordinator. In addition, work has been supported through the work of over 50 volunteers at our various events.

**Impact:** RAFFL has received eight inquiries from property owners interested in possibly siting the Farm on their land, all generated from outreach associated with the September Public Meeting and mailings to Rutland Town and Clarendon Land Owners.

RAFFL built relationships with 27 separate local farms and value added producers by sourcing ingredients and highlighting their operations at local food dinners. Responses from 92 consumers to a survey indicate that:

- 82 percent bought more locally grown products and services this past year than the year before;
- 63 percent of all respondents feel that the local community is “more aware” or “somewhat more aware” of local food and farming because of RAFFL programs;
- 49 percent stated that they had asked at a retail store or restaurant where a food item was grown; and
- 87 believe RAFFL services benefited them.

Respondents that increased their purchases of local goods:

- increased their purchasing of locally grown products and services this year, adding between \$24,900 and \$58,564 to the local farm economy;

- bought at least \$145,000 in local farm products and services over the 2006 growing season;
- are primarily buying local goods at farmers' markets (81 percent), farms and farmstands (72 percent) and retail stores (67 percent); and
- attributed the increase at least in part to RAFFL efforts (63 percent), with 28 percent attributing the increase to use of RAFFL's Locally Grown Guide and 27 percent to attendance at one of RAFFL's local dinners.
- Future actions include plans to:
  - use the RAFFL website as an information hub bringing together farmer, consumer and organizational resources regarding agriculture, with links to current resources, VT-FEED website, and lists of useful information for farmers looking to sell to institutions;
- host quarterly speaker series to provide useful information from cafeteria food service director, Black River Produce representative, Rutland Regional Medical Center nutritionist, and provide information fairs at these meetings with handouts and resources for attendees;
- host a two-part workshop on farm to restaurant table, the first workshop held at a farm, the second at a restaurant;
- provide co-op and other interested retailers in farmer profiles produced by Green Mountain College class for use as marketing/promotion piece;
- host five farm tours during summer months (May to September), and print schedule in 2007 Locally Grown Guide;
- form a committee to work on institutional purchasing issues and continue work started with Farmers Gathering; and
- publish email (and mailed version when needed) newsletter four times a year to include RAFFL updates, volunteer opportunities, events, project status, and legislative updates from local representative(s)

**Sources of Federal Funds:** Hatch funds/ SARE

**Scope of Impact:** State-specific

## Goal 1

**Key Theme:** Agricultural Profitability  
Diversified/ Alternative Agriculture  
Niche Markets

**Issue:** The United States Food and Drug Administration (FDA) developed labeling standards in 1994 for the rBST attribute, and organic standards were introduced in 2002 (FDA, 2001; Pickrell, 2002). However, no political consensus exists on the regulation of either rBST free or organic attributes, and there continues to be debate over the labeling of these attributes among industry and consumer groups. Using two years of consumer data and a hedonic model, we explore how the labeling of process attributes of milk has impacted consumer valuation of these attributes. The impact of affect on the valuation of the rBST free characteristic is of central interest. If labels have been misleading and less than factual, consumers who are misinformed may “feel” that rBST free milk is better than other milk and place a higher value on the attribute. Knowing this information is useful to determining whether labeling of these attributes is an appropriate policy tool. It can also aid in niche marketing decisions of the dairy industry, which has struggled with declining profitability in recent years. Understanding how consumers value process attributes can help producers make more profitable production and marketing decisions, while meeting the demand preferences of consumers who are willing to pay a premium for a differentiated product. This is the first study of its kind to examine whether and how affect has played a role in consumer

**Activity:** UVM researchers conducted a study to determine whether labels may provide affective information that leads consumers to place a higher value on the rBST free characteristic because they “feel” it is superior to milk produced with rBST. Using two different statistical specifications, Box Cox and semi-log, the study indicated that by 2004, labels did not mislead a consumer into believing that it was somehow “better” than milk produced using rBST, yet buyers were willing to pay more for the product than in previous years.

The findings of this study are important at several levels:

- for proponents of labeling, evidence points to a movement toward rBST free and organic labels as informational signals instead of signals associated with subjective feelings (affect);
- demographic segments exist that are willing to pay a premium for the rBST free attribute;
- there are niche markets for rBST free and organic dairy farms, and a premium associated with the market among women and households with children;
- production and marketing chains can use this information to develop value added niches in an industry struggling to remain viable and profitable in the United States; using FDA guidelines, producers can label their milk, knowing that a certain segment of the population places a monetary value on the rBST free attribute; and
- meeting consumer demand for the rBST free attribute can only occur if there is a signal, for example in the form of a label.

Additional research must be conducted in other regions of the U.S. to identify the magnitude of that value for various geographic regions in order to ascertain whether the value added to the

product is worth the cost of labeling and marketing the rBST free attribute. Milk processors and distributors particularly will be interested in predicting any surplus that can be gained through segmentation of the milk market based on the marketing of the rBST free attribute.

**Impact:** In 2006, there is evidence that labels may have been effective, as researchers observe that in the Northeast, milk processors have responded to the consumer pull for rBST free fluid milk. H.P Hood and Dean Foods, the two major regional fluid processors, announced in the fall of 2006 their intentions to only accept rBST-free milk from haulers at selected New England facilities.

Previous milk labeling marketing efforts presented an ambiguous and potentially deceptive distinction between a product's factual attributes and the product's affect-oriented benefits; the FDA's recent enforcement of its own labeling guidelines has mediated the influence of affect on misinformed consumers. Enforcement paves the way for clearer informational messages; messages that do not lead consumers to make decisions based purely on their emotions.

**Sources for Federal Funds:** Hatch

**Scope of Impact:** State Specific

## Goal 1

**Key Theme:**            **Agricultural Profitability**  
                                 **Diversified/ Alternative Agriculture**

**Issue:** A movement towards larger dairy farms in the Northeast has led to widespread adoption of monoculture silage corn production. Crops grown in monoculture can have negative impacts on the environment. Since there are so few annual forage crops that can be grown in the Northeast the introduction of alternative high yield and quality annual forage crops would lead to more extended rotations. A plausible alternative forage crop for the Northeast is fenugreek (*Trigonella foenum-graecum* L.). Fenugreek is an annual legume that is similar in quality to alfalfa. It is only cut once during the growing season and can be harvested for hay or silage. Fenugreek does not lose quality as it matures and therefore has a longer harvest window than corn silage or alfalfa. The objective of this study was to evaluate the performance of forage fenugreek varieties in Vermont.

**Activities:** In fall of 2004, trials were established on two fields located in Grand Isle, VT. There was at least three years of continuous corn silage production previously grown at the sites. Treatments included five cropping systems utilizing a randomized complete block design with four replications, 1) continuous corn, 2) continuous corn with a winter cover crop, 3) double crop alternative forages (winter rye and bmr sorghum sudangrass) grown for two consecutive years, 4) double crop alternative forages grown for first treatment year only, and 5) double crop system only in second treatment year only. Measurements included dry-matter yield, forage quality, soil quality, rootworm populations and soil cover. Changes in soil health will be assessed by monitoring soil active carbon, total carbon, respiration, infiltration, bulk density, earthworm counts, and aggregate stability. Soils will be sampled in the fall of 2004 before treatments are imposed. Thereafter soils will be sampled before every crop planting and after every crop. Crop nutrient balance will be calculated as the difference between nutrient inputs and nutrient uptake. Indirect measurements of the water quality will be made from a comparison of the pesticides applied, crop residue cover, changes in soil health and the crop nutrient balance of the different systems over the study period. Yield of all crops will be measured from each sampling area. Quality of forages will also be determined by analyzing for crude protein (CP), in vitro true digestibility (IVTD), neutral detergent fiber (NDF), acid detergent fiber (ADF), digestible NDF (dNDF), and minerals. Animal performance indices Milk per Ton and Milk per Acre (Schwab et al., 2000) will be used to evaluate the economic value of the forages. The net value of the proposed alternative cropping systems minus conventional corn as well as the input costs of production of each cropping system will be used to determine a net economic return.

**Impact:** In 2004 and 2006 dry matter yields ranged from 2.0 to 4.5 tons/acre. Forage quality was higher in 2006 than 2004. On average, crude protein was 27 percent higher and fiber content 30 percent lower in 2006 than 2004. In general, forage quality among varieties was similar. Although yield and quality were lower than alfalfa in 2004, researchers felt that a devastating bacterial disease actually lowered yields and quality. In 2006, yield and quality were similar to alfalfa but strong weed pressure most likely limited yields. Overall, fenugreek quality was much better in 2006 than in 2004, with the 2005 crop abandoned due to lack of growth on the selected plots. When compared to alfalfa forage produced on the same farm, fenugreek

produced a more digestible feed with slightly lower protein. This feed would provide a much needed energy and protein source on the farm and potentially lower grain costs. Fenugreek provides more flexibility over the harvest season because it does not lose quality once it flowers. This is in contrast to alfalfa which greatly declines in quality as soon as it flowers.

Through media articles and research reports more than 1000 farmers have been exposed to information about growing this new crop in the Midwest and Northeast. At the Vermont field day in 2006, there were 78 farmers in attendance, with many interested in research results about the crop. In a post-event survey:

- 80 percent of farmers responded that they would experiment with fenugreek if a suitable cover crop was determined for weed control;
- 80 percent would rotate out of corn if there was an acceptable replacement that met yield and quality needs of the farm;
- Respondents felt that disease could be managed through harvest timing;
- 98 percent of agricultural professionals that attended the meeting were interested in finding an acceptable annual crop to rotate with corn silage.

Before fenugreek can be integrated into a Northeast cropping system more research needs to be conducted on the two production barriers highlighted in this project. First, the bacterial leaf spot needs to be managed or the crop will never produce to its maximum potential. The two varieties that showed some tolerance to the disease can be grown and selected for disease resistance. The seeds can be saved and resistance populations developed locally. This disease has not been seen in Alberta as the climate is more arid than Vermont. Second, weed control problems need to be addressed. In the northeast it is not considered economically feasible to control weeds in forage plantings with herbicides. Generally, a cover crop is seeded with forage plantings to minimize weeds while the crop establishes. However, since fenugreek is an annual and only one cutting is removed a season it will be difficult to find a cover crop that can coincide with the harvest time frame. Fenugreek expert, Dr. Acharya, has expressed interest in working with UVM Extension to further develop fenugreek for more temperate climates.

**Sources of Federal Funds:** Smith Lever 3 (b) & (c)/Hatch funds/ SARE

**Scope of Impact:** State-specific

## Goal 1

**Key Theme:** Agricultural Competitiveness  
Alternative Agriculture  
Bio-fuels

**Issue:** 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 biofuels, 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.

**Activity:** To advance education of farmers regarding the use and economic value of biofuels on farms, Extension personnel have:

- UVM Extension hosted a forum in FY2005 on Alternative Farm Energy that brought in 79 farmer, educator, and agency participants, and covered topics including on-farm production of biofuels, converting furnaces to burn waste vegetable oil, methane digester technology, willow biomass fuel production, and wind and solar power use on farms;
- provided dozens of tips to farmers on how to save money and who to contact for problems, distributing two mailings to a 3,800-strong mailing list, linking information with key governmental agencies, and with a well-broadcast television appearance and website;
- developed a Farm Equipment Energy Savings Factsheet with the Dairy Task Force/Agency of Agriculture sent to 3800 farm households;
- developed a farmer-oriented website with Energy activity (with an average of 250 hits per quarter);
- assisted in incorporating information regarding the Energy Tax Bill for the UVM Extension Income Tax School;
- created four Energy Articles for Agriview, reaching 4000 subscribers, eight Across the Fence Energy programs reaching 60,000 people, published three articles for the American Agriculturalist journal fielded twelve calls and responded to dozens of email requests for additional information;
- created an energy display for the Vermont Farm Show and VT Legislative visit

**Impact:** There were 164 "hits" on the website immediately after two "Across The Fence" television broadcasts, and nearly 300 hits in the six weeks following website publication. Even with higher costs of energy, there are three verifiable stories of farmers able to hold energy costs stable because of implementing conservation methods described in mailings which were described in the Burlington Free Press and Northeast Agriculture magazine.

On-farm work focused on developing on-farm biofuels for local farm use. Two farms have been the focus of on-farm research and demonstrations aimed at growing and processing oil-seed crops (canola, flax, mustard, soybean, and sunflower) for production of biofuels. Heavy rains created a difficult growing season, but most crops performed well, were harvested, and are being pressed for oil in a newly constructed processing facility.

In 2007, Extension personnel plan to expand one on-farm biofuels system and set up a second processing facility in another county. This model can be replicated on farms throughout the Northeast, focusing on production of biofuels for local farm use. This differs from the Midwest model where farmers grow large volumes of energy crops for sale at commodity prices to large processing plants. The former model is a better fit to the scale of production and economic realities of farming in New England.

The Sustainable Agriculture Council in Vermont is supporting these efforts as well focusing on research into farm-scale alternative energy production, use of waste oils, and co-generation (electricity and heat production) from bio-gas. Council members are currently updating information compiled by the Biomass Research and Development Initiative's "Evaluation of the Economic Benefits to Farmers" with data to reflect current markets of producing biofuels, in addition to animal feed, from oil seed in Vermont.

**Success Story:** At this year's Vermont Vegetable and Berry meeting at the Farm Show, one farmer described in a presentation how, with the help of a SARE Farmer/Grower grant, he produced 700 gallons of bio-diesel from used vegetable oil collected from local diners. He used this renewable clean burning fuel to heat two tomato greenhouses and a tractor, and he presented the economics of making and using on-farm bio-diesel compared to buying conventional fuel oil. An attending farmer was sufficiently inspired to study the topic further, and he now produces over 2,000 gallons of bio-diesel on his farm -- enough to heat seven greenhouses, his home, and to run several tractors and cars. This farmer has become a leading biofuels farm educator in Vermont, giving presentations at the Northeast Organic Farmers' Association conference, at vegetable and berry grower meetings, and hosting a UVM Extension-taught Renewable Energy class. The farmer can clearly explain the procedure and costs through his experiences, emphasizing farm safety, and providing hundreds of other farmers across the state with useful information.

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

**Scope of Impact:** State Specific

## Goal 1

**Key Theme:** Agricultural Profitability  
Diversified/ Alternative Agriculture

**Issue:** Maple syrup production represents a significant portion of income for 2000+ Vermont landowners. Syrup production is not only a part of the state's agricultural heritage, but a viable industry that offers part-time employment for thousands of individuals each spring, plus full-time employment for many Vermont retailers, packers, equipment manufacturers. Syrup making also adds significantly to Vermont tourism dollars, and serves as an incentive for many landowners to maintain healthy forests. Following is a description of current research and outreach milestones, and results of an evaluation survey to measure the long-term impact of UVM Extension maple industry outreach.

**Activities:** To reach target audiences with this and other practical and valuable research information during FY2006, UVM Extension

- developed and hosted five 2006 Vermont Maple Conferences prior to the 2006 sugaring season, reaching 539 attendees, including trade-show exhibitors and speakers;
- presented educational workshops on topics included all aspects of maple, from woods management, to sap collection, syrup production, marketing and sales;
- advised and assisted the Vermont county hosting a two-day series of tours with exhibits during the summer months, called Maplerama, that attracts nearly 250 sugarmakers from twelve states;
- compared sap sugar content from maples defoliated during the summer of 2005 by Forest Tent Caterpillar larval feeding with sap from undamaged trees to determine the feasibility of tapping such trees in the future, and shared with sugarmakers results indicating that there was almost no difference in sap sugar content between defoliated and undefoliated trees;
- supported the VT Maple Festival celebrating the year's crop with tastes, demonstrations, and education opportunities for thousands of general public participants around the state;
- presented research findings at five other events in-state, out-of state (e.g. 150 participants at the Ohio Maple Conference), and abroad (250 attendees of the North American Maple Syrup Producers in Three Rivers, Quebec ) on one commercial television and on five radio broadcasts during the year highlighting practical research results;
- wrote and edited sections of a new Maple Producers Manual, including writing new sections on nutrition and fertilization of maples stands, methods of cleaning maple tubing, and layout of tubing systems for sap collection;
- converted sets of important maple references into electronic form for incorporation into the Maple Extension Webpage;
- advised maple organizations, including the Governor's Tree Tapping Committee and the Vermont Maple Sugar Makers' Association;
- worked with Natural Resources Conservation Service to plan a program to reimburse sugarmakers in selected watersheds for environmentally sound sugaring practices, through the new Conservation Security Service, and now qualifying maple producers in certain watersheds of Vermont may now receive federal benefits for enhancements that

are based on sound environmental practices but may lead to greater expense and lower sap yields;

- advised VT Forest and Parks, scientists, and concerned sugarmakers in developing a plan to address expected 2006 defoliations by Forest Tent Caterpillar and Lecanium Scale, and to deal with the likely outcome from the 2005 defoliations;
- more formally addressed a youth audience through two school workshops held at an Extension outreach specialist's own sugarhouse, and by conducting a Maple Magic workshop at this year's 4-H Teen Congress, where six youth participants learned how to make three value added products with maple syrup. Comments included, "This was a lot more fun than just sitting in class" and "Wow, I never knew you could make all these neat things with maple syrup."

**Impact:** Evaluations of long-term education and outreach efforts working with sugarmakers were conducted during FY2006. Of the surveys sent to 2400 known maple sugar makers reached through programming, 33 percent (800) responded. Responses show 61 percent of sugarmakers attended one or more maple syrup conferences sponsored by UVM Extension during the past three years, and as a result of attending:

- 85 percent believe attending the conferences has helped them to improve their maple sugaring operations;
- 80 percent have improved their sugarbush management practices;
- 71 percent now use newer maple production technology;
- 50 percent have improved their marketing knowledge and techniques;
- 49 percent have improved sap production efficiency (more syrup per tap);
- 47 percent have increased production volume (gallons); and
- 38 percent have increased the size of their maple operation.

Improvements made to sugarbush operations include culling non-maples and thinning non-productive maples (more than half of all respondents), while nearly one-third of all respondents stated they had developed forest management plans, and at least 25 percent of respondents stated they had improved access roads, measured tree sweetness, and/ or inventoried trees in their sugarbush. However, only eight percent of respondents stated they had tested and/ or amended soil to improve their sugarbush stands.

More than 75 percent of sugarmakers stated they changed tapping and processing practices to include hot-packing all syrup, improving tapping practices, and switching to smaller spouts. More than a third of all respondents stated they have added vacuums to pipelines and increased the efficiency of arch, burners, preheaters, hoods, and/ or steam-aways, while 25 percent have installed dryline/ wetline systems. More than half of respondents stated they now:

- no longer use of chlorine to clean sap lines and they do clean immediately after sugaring;
- have replaced old tubing and updated tapping equipment;
- strain all sap and use only approved defoaming equipment;
- have upgraded to stainless steel evaporators and eliminated galvanized sap tanks;
- have eliminated all contact with lead and lead solder; and
- have improved operation safety features.

From the survey, UVM Extension learned that sugarmakers make use of the wide options available for communication, with the primary means of interacting with maple specialists (90 percent of respondents) being through the work they do with the maple sugarmakers' business organizations and the Vermont Maple Festival, followed by group meetings, workshops, and conferences (85 percent), telephone consultations (75 percent), on-site consultations (74 percent), website checks (73 percent), and email consultations (67 percent). The least used method (41 percent) has become the in-office appointment. Of those responding, nearly all read the Maple Mainline newsletter, and 99 percent feel the widely distributed newsletter provides useful information, assists producers in registration, and should continue to be produced and distributed.

Based on results of the survey and other information sources, a North American Maple Syrup Council sponsored project was established at the PMRC (Proctor Maple Research Center) to examine differential timing of tapping and the effects of tapping date on total sap yield. Current research also focuses on how different sap collection methods affect sap yield, and results will help outreach specialists work with sugarmakers to determine when retubing a sugarbush is economically viable. Research and outreach continues on a long-term project examining the effects of weather and tree physiology on sap pressure and flow, showing how air temperature relates to wood temperatures in various parts of the tree, which are critical in determining sap flow (data presented live via the PMRC Website TREEMET, an electronic monitoring program showing temperature, sap pressure and sap flow in maple trees at the PMRC that includes real-time display on the PMRC website).

**Success Story:** Operation Maple Sweetness was a project of the State of Vermont, the sugarmakers of Vermont, and Extension personnel who work with producers and reported on the project. Over 800 gallons of Vermont maple syrup were canned and shipped to Iraq in 12,800 ½-pint containers. Quotes from soldiers enjoying the syrup:

- "I just wanted to let you know that your campaign to send maple syrup to the troops was greatly appreciated. I am currently deployed to Iraq and it made me miss my wife and three kids. I am not from Vermont but my wife was born and raised there. During breakfast it brought a smile to my face, and it made me think of her and my children. Thank you for bringing that smile to my face!"
- "This morning I sat down for breakfast and these cute little bottles of syrup were on the table. I had already broken my diet by picking up a biscuit and then it was thrown out entirely by pouring your syrup on it. Heaven!!"
- "Hi, ...I have heard nothing but praise and thank you's for what you people did this year. They also said that the Marines and others got to share in the "Sweetness" and loved it."

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

**Scope of Impact:** Multistate (New England)

## Goal 1

**Key Theme:** Agricultural Profitability  
Diversified/ Alternative Agriculture

**Issue:** Diversity helps sustain Vermont's agriculture. Of Vermont's 6,571 farms, 207 produced berries, 413 grew vegetables, 98 raised greenhouse vegetables, and 418 sold nursery and floriculture crops. The New England Agricultural Statistics Service estimated the value of production from these farms in 2003 at \$38.6 million. Much of the production from these farms is consumed by Vermonters through direct and local-markets, a practice that is expanding steadily. As a result, farmers are becoming more entrepreneurial, and getting more involved in value-added production and alternative markets such as organic and farm-branded products. The continuation of these changes is likely given the relatively low and unstable prices of wholesale commodity markets, as well as the growing interest among consumers in fresh, local food that contributes to healthy lifestyles and strong communities. To be successful with new markets, new practices, and new consumer interests requires new knowledge on the part of farmers. To help diversified growers prosper in this changing environment, UVM Extension and VT- AES play key in planning and delivering a comprehensive program aimed at enhancing the profitability, stewardship and management of vegetable and berry farms in Vermont and the region.

**Activity:** To achieve results during FY2006, UVM Extension and VT- AES personnel:

- gave more than 30 presentations to farmers and elementary school children in VT, MA and NH;
- authored more than 60 articles and columns;
- taped 10 radio programs;
- made 200 farm visits;
- provided over 700 phone and e-mail consultations to commercial growers;
- produced a 2-minute instructional video on grafting greenhouse tomatoes;
- reviewed articles on farming, such as "A Legal Guide to Farming in Vermont" and two Oregon State Univ. videos on weed control;
- maintained the VT vegetable and berry web site;
- developed agenda and registration process for Climate Change & Ag workshops in CT and MD;
- taught a for-credit UVM Continuing Education summer course on sustainable agriculture;
- assisted in putting on the New England Vegetable and Fruit Conference and Trade Show, planned by 30 people from seven states, representing extension, farmers, industry and research -- included 25 half-day educational sessions with 118 individual presentations, and six farmer-to-farmer discussion sessions on topics ranging from alternative energy to winter growing; had 117 commercial and non-profit exhibitor; and had a total attendance over 3 days of 1,290 people, including 238 people associated with the trade show, and 138 speakers and conference workers;
- conducted a one-day workshop on growing greenhouse tomatoes, as this is a profitable northeastern product, to which over 80 people from Connecticut, New York, Quebec and Vermont attended;
- wrote a grant awarded \$98,089 to study on-farm oil seed crop production and processing;

- wrote a grant receiving \$99,504 to produce a video on sustainable tillage practices;
- assisted in planning the England Vegetable and Fruit Conference and Trade Show;
- conducted a Greenhouse Tomato-growing school; and
- assisted in linking interested farmers with quality farmland to purchase

**Impact:** An evaluation mailed to 489 known Vermont growers received a 19 percent return rate. From the 94 respondents farming 1493 acres, employing 584 people, and totaling over \$7 million in gross sales, Extension learned that:

- 90 percent feel that the vegetable and berry programs offered by UVM Extension improved their farm profitability; and
- 79 percent believe the programs have led them to adopt a new to improve their operation.

The 80 attendees (based on a 78 percent post-workshop survey return rate) at the one-day greenhouse tomato-growing workshop stated that as a result of attending:

- 97 percent would improve their production practices;
- 85 percent would improve farm profitability; and
- 85 percent will make changes to their greenhouse operation.

The program was so successful it has been replicated in CT, achieving similar success.

**Success Stories:** Pesticide applicator recertification credits were offered for 22 out of the 25 session at the New England Vegetable and Fruit Conference and Trade Show; a total of 31.5 credits were offered during the conference and 251 New England growers received credits. A 328-page conference proceedings summary of 76 presentations was published.

Two aspiring young farmers received assistance from Extension and the Vermont Land Trust, among others, to purchase a farm. They have successfully purchased a 28-acre field of river-bottom soil in Vermont, and are establishing farm infrastructure and markets for the horticultural products they intend to produce.

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

**Scope of Impact:** State Specific

**Key Theme:            Agricultural Profitability  
                             Diversified/ Alternative Agriculture**

**Issue:** Cold climate wine grape production is an emerging new crop in Vermont and the region offering exciting value-added and agri-tourism economic opportunities. A key challenge to this young industry is the selection of wine grape cultivars which will consistently produce high quality fruit under our variable environmental conditions. High quality fruit is the basis for quality wine production. The high cost associated with planting each acre of grapes (approximately \$4,500 to \$7,5000) makes it critical for growers to plant cultivars that will survive Vermont winters, perform consistently well, and produce outstanding fruit and wine that offer the consumer a high-quality product and the grower economic success. No testing of the adaptability, productivity, and fruit and wine quality has been conducted in Northern New England, where climate is the major limitation for the successful establishment of many cultivars.

**Activities:** Work in FY2006 included:

- planning research and establishing protocol to evaluate cold-hardy winegrape cultivars in association with multistate project, NE1020 “Multistate Evaluation of Winegrape Cultivars and Clones”;
- updating the Vermont grape growers database created in 2004, to include new growers;
- further developing the University of Vermont Cold Climate Grape Production web page, <http://pss.uvm.edu/grap/>, (contains a primer on integrated pest management; links to eleven newsletters showing high-quality photos of specific diseases, insects, and physiological conditions affecting wine grape cultivars, and growing season observations from the field; links to web pages of industry resources; university and extension information regarding grape production; and weekly accumulation of growing degree days from various locations in Vermont);
- summarizing research data on horticultural performance of select wine grape cultivars at four commercial vineyards; and
- organizing and conducting a vineyard tour/workshop for 60 individuals with discussion of factors that impact grape production.

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 and 2006 growing seasons 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.

**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. In addition to the French hybrid varieties dominating production, cold-hardy clones of vinifera varieties like Riesling and Zweigelt are also in the ground, with results pending.

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. 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:** Multistate (CA, CO, IA, IN, MA, MD, ME, MI, MN, NE, NY, PA, SD, TX, VA, VT, WA)

## Goal 1

**Key Theme:** Agricultural Competitiveness  
Plant Health  
Plant Production Efficiency  
Animal Production Efficiency

**Issue:** Soils degrade when intensive agriculture takes place over a number of years.

**Activity:** The “Dirt on Soil” is a three-day integrated soil learning course 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; 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:** During FY2006, 60 farms attended each event. Results from the first two years of the program show several impacts.

- All participants surveyed (n=30) reported increases in knowledge of soils.
- Follow-up evaluations (23 of 40) showed that 75 percent 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.
- A large proportion of participants (23 of 40) returned for a reunion, commenting 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.
- As a result of these workshops bi-annual soil and forage workshops are held in September and March.
- There has been a 50 percent increase in the number of requests for soil management information, and of the core group of 40 farmers, 85 percent have begun soil testing and monitoring their soils.

**Success Story:** Quotes from farmers:

- "I would say the best outcome for my farm has been learning about the impact of "wide swath" hay management on forage quality. It has improved my feed quality tremendously, reduced time of harvesting, and certainly has improved economics and quality of life."
- "I think you really inspired us all to take care of our soils."

- "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 land. 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."
- 

The UVM Extension curriculum developer has been invited to speak at two national meetings about the program.

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

**Scope of Impact:** State Specific

## Goal 1

**Key Theme:** Agricultural Profitability  
Small Farm Viability

**Issue:** Beginning farmers (those in business for less than ten years) comprise about 26 percent of Vermont's approximately 6,500 farms. Many beginning farmers come from non-farming backgrounds who may have little to no experience in the production, marketing and business skills needed for successfully maintaining an agricultural enterprise. For many new farmers, a successful farm business begins with the creation of a comprehensive business plan.

**Activity:** Starting in January 2006, a course called "Tilling the Soil of Opportunity" provides new and experienced farmers with the tools to develop an agricultural business plan. The course is designed for farmers thinking about a new agricultural venture, whether it be to diversify their current operation or as a start-up business. To that end, participants assess their resources, develop marketing strategies, understand financials, learn how and where to get funding for their businesses, and network with other farmers.

**Impact:** Forty people participated at one of three Vermont sites. Participant evaluation results show:

- 22 percent were start-up farmers interested in grass-based beef, pork and poultry, organic vegetables and small-scale dairy production; and
- 80 percent state they will start their agricultural business or revise business objectives as a result of taking the course.

Nearly all (97 percent) of 95 farmers who have participated in Tilling the Soil workshops since its inception, stated that the course met their expectations and they planned to use the information to begin or expand an existing agricultural business, or revise business objectives.

**Success Story:** "Tilling the Soil of Opportunity armed us with the skills and resources needed to successfully write a business plan," said a farmer couple operating a beef farm. "However, this class did much more for us than give us a template to write the plan. Tilling the Soil taught us how to identify our core values and goals for the business as well as how to effectively communicate them. The classroom environment allowed us to share ideas and concerns with other participants and to network with them."

**Activity:** UVM Extension's Center for Sustainable Agriculture coordinated a New Farmer Network that assists beginning farmers in a variety of ways. The group:

- maintains and distributes electronic and print versions of a resource guide to various services and organizations helpful to new farmers (more than 300 distributed in 2006);
- coordinates quarterly meetings to serve beginning farmers;
- offers seminars on production skills
- offers workshops addressing new approaches to farmland access
- creates and conducts courses on production, marketing and business development;

To assist beginning farmers in gaining practical skills, a full-day, farm-based workshop, "From the Ground Up," was conducted, where eight farmers and agricultural service providers provided participants with practical information on managing key mechanical systems on horticultural farms-greenhouses, irrigation and cultivation. Participants also learned about direct marketing strategies for vegetable and berry growers, and Vermont resources for beginning farmers. Cedar Circle Farm, a 50-acre organic vegetable and berry farm and education center, hosted the workshop. The workshop was the first of two supported by a grant from NECRME aimed at combining research-based information with hands-on learning for beginning farmers. Workshop content included four topic areas:

- Greenhouses & High Tunnels, which covered siting considerations, pipe frame construction, and management of heated greenhouses and unheated high tunnels;
- Irrigation Approaches, which covered general principals for irrigation on horticultural farms, including both trickle and overhead systems, figuring out how much water is needed, when to put it on, when to shut it off, and pump and filtering options;
- Equipment, Tools and Techniques for Weed Management, which covered basic principals of mechanical weed control and demonstrations of several implements and tractors the farm uses; and
- Diversified Marketing for Horticultural Farms, which included some of the considerations, opportunities and challenges associated with marketing through farm stands, CSAs, to restaurants and through special events.

**Impact:** More than 44 beginning and aspiring farmers from Vermont, Massachusetts, New Hampshire and New York acquired skills and new information at the workshop. Nearly 50 percent of attendees are currently farming on a commercial basis, selling a minimum of \$1,000 worth of product annually. Sixty percent of attendees farming on a commercial basis said they are currently farming five or fewer acres, while the rest were farming between 15 and 70 acres. From a 57 percent response rate, participant self-reporting evaluations indicate that 96 percent of attendees came away with at least one new technique they will use on their farm.

A winter 2006-2007 event, partnering with Northeast Organic Farmer Association of Vermont, will offer a Direct Management course covering marketing and financial management topics to 120 farmers.

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

**Scope of Impact:** State Specific

## Goal 1

**Key Theme:** Agricultural Profitability  
Small Farm Viability  
Animal Health

**Issue:** 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 Program. The program offers Vermont farmers help with business planning and technical assistance to help them improve and develop their agriculture business. Also, winding the way through legal aspects of farming can sometimes be as challenging as contending with the ups and downs of the growing season.

**Activity:** 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 2006, the program completed 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:** Since its inception three years ago, 112 Vermont farms representing 45,600 acres of productive farmland have been referred to the Farm Viability Enhancement program. The Farm Viability Enhancement Partnership has provided business planning/technical assistance to 112 dairy and diversified farmer applicant:

- all participating farmers 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;
- more than 40 farmers have completed full business plans; the first 20 farms completing business plans represent \$4.8 million in cash receipts, \$8 million in equity, \$12 million in assets, and 11,270 acres of farmland.

**Activity:** UVM Extension planned, organized, and carried out the third annual two-day VT Large Farm Dairy Conference in 2006, which was very successful at attracting close to 300 dairy producers, industry and students.

**Impact:** Follow-up evaluation results from the 2005 conference were very positive:

- 60 percent of those attending in 2005 stated they have made a management change that improved their quality of life and/or farm profitability.

Evaluation results of the 2006 conference also show promise:

- 50 percent of 18 responses indicated that farmer attendees plan to make a change that will improve farm profitability as a direct result of attending this conference; and
- 65 percent of 31 responses indicated that attendees plan to make a change that will improve their quality of life as a direct result of attending this conference.

**Activity:** During 2006 UVM Extension personnel also conducted five Agricultural Business Management classes, with 115 attendees. Thirteen farmers at eight clinic locations worked on developing and improving budgets and balance sheets.

**Impact:** Of 30 participating farmers who developed balances sheets and budgets in the past three years, 88 percent stated that they had used balance sheets and budgets created that year, with most sharing the information with other family members and lenders to improve operations.

**Success Story:** This helped one dairy farm family to have funds and appropriate plans to begin building a new dairy facility to make their current operation more labor efficient, comfortable, and profitable.

**Activity:** Land Link VT links farmers and non-farmers interested in selling and purchasing farm land, and offers support for new farmers and farm families making transitions to the next generation:

- 15 workshops and courses were organized by LLVT during 2005, attended by 523 farmers and service providers;
- LLVT Partnered with Vermont Small Business Development Center during FY2005 and FY2006 to offer a “Tilling the Soil” business management course in three sites across Vermont;
- more than 640 families participated in UVM Extension’s Land Link Vermont (LLVT) service, making connections among farm seekers and farming opportunities, and currently the service has 123 enrollees;
- survey results conducted with the assistance of a UVM undergraduate student found that 68 percent of farm seekers were currently farming on either leased or owned land, their greatest challenges revolve around finances (eg., start-up costs, on-going cash flow, cost of farmland), and their greatest need is business management education.

In cooperation with other New England states, UVM Extension has conducted 14 workshops for 469 individuals over the past 3 years to assist farmers in estate planning and successfully transitioning out of their farm businesses. The impacts of estate planning and farm business transition are difficult to document.

**Impact:** Workshops and approximately ninety farm visits over the past three years have yielded more than twenty successful farm transfers, representing approximately 1800 acres of farmland.

**Success Story:** A successful link assisted a couple in purchasing a 90-acre farm from Vermont Land Trust to expand an organic vegetable, dried bean, and grain business.

An agreement enabled an interested young couple to begin realizing their dream of dairy farming with a secure and well thought out plan, while providing a retiring farm couple with the means to

ease their way out of dairy farming and continue to draw an adequate income in addition to staying involved with the farm, and being assured their successful business continues to operate.

As part of a LLVT multistate project to help provide support for new and beginning farmers across the U.S, Vermont's beginning farmers now have access to a new loan opportunity. UVM Extension's Center for Sustainable Agriculture staff for the project, Farmers: A New Generation, obtained a grant through Heifer International to help states create a loan fund to help beginning farmers in their acquisition of livestock for their farm businesses. Beginning farmers (i.e. farming less than 10 years) in Vermont are eligible to apply for the loan. The loan can be used to acquire: dairy cows, beef cows, goats for milk or meat, sheep for milk or meat, poultry, and other livestock or equipment by special request. It is open to both organic and non-organic farming enterprises, and both commodity and direct-marketing approaches. The livestock loan program uses Heifer International's "passing on the gift" philosophy where loan recipients will pass on or share with others their knowledge and experiences. Loans made will range from a minimum of \$1,000 to a maximum of \$15,000 per loan per family. A 3 percent interest rate will be applied to each loan to support the continuation of the project. Loan repayment will occur in 1 to 5 years, and can be customized to applicant's operation. Loans will be made on a competitive basis; recipients will be selected based on the information provided in their application, and upon a site visit conducted by a loan committee made up of farmers and service providers.

**Activity:** With funding from the Northeast Sustainable Agriculture Research and Education program (NE-SARE), a publication has been created to navigate the legal terrain. "A Legal Guide to the Business of Farming in Vermont" is a publication of UVM Extension's Center for Sustainable Agriculture. The lead author is Annette Higby, an attorney from Randolph who has spent her career working with farmers. In addition to Attorney Higby, several contributing authors -- including attorneys and staff from a number of Vermont agricultural organizations -- provide their expertise in the nine chapters that make up the guide addressing: the legal structure of the farm business; farm transfer and estate planning; farmland tenure and leasing; and regulation of farm labor, organic agriculture, agriculture and land use, and on-farm food processing and marketing. The guide is primarily intended for use by Vermont farm service providers -- Extension, land trust, and farm agency personnel; attorneys; and others who work directly with farmers on farm start-up, farm viability, or farm transfer issues. It is a reference tool that can be used to help farmers identify areas that need additional research or technical assistance in their businesses. Farmers find the guide useful. While not a substitute for legal advice, the guide may be a useful resource when developing a list of questions for an attorney, accountant, or farm service provider. In addition, farmers may use it to identify and address issues that need to be included in the farm's business plan or to become better informed consumers of legal or farm viability services. The guide is available on-line at [www.uvm.edu/landlinkvt](http://www.uvm.edu/landlinkvt).

**Impact:** More than 100 Extension faculty, state and federal employees, and farmers have downloaded the guide to date. A reader evaluation revealed that:

- 87 percent believe the guide increased their awareness of legal information pertaining to farms in Vermont;

- 60 percent will make a change to their farm or work with farmers as a result of using the guide.

**Sources of Federal Funds for all activities listed in section above:** Smith Lever 3 (b) & (c)

**Scope of Impact:** State Specific

**Activity:** UVM Extension's modified version of the Dairy Profitability Enhancement Program (DPEP) has been successfully implemented. The Dairy Profitability Enhancement Program (DPEP) is a program for dairy families to analyze their dairy system in cooperation with their farm diagnostic team. The primary goal of the DPEP is to increase the profitability of dairy farms participating in the program. The program is a cooperative effort between UVM Extension, milk processors, agricultural professionals, dairy farm families, and the Vermont Department of Agriculture. The cost of the program (\$1,000 per year) is shared by the farm family (20 percent of cost), since they receive the most benefits. Some farms have made tremendous changes in their financial situation because of diagnostic teams. To take part in the program, dairy producers must:

- Plan to continue in the dairy business
- Work with a team to develop short and long-term plans for their farm
- Be willing to make changes
- Provide production records for their farm (records are confidential)
- Network with other dairy producers to share ideas and information that work on the farm
- Participate in the program for at least one year

**Success Stories:**

- One farm working with a team for three years now uses the New York Farm Business Summary to watch for trend analysis, leading the farmers to realize a nearly \$250,000 increase in net worth over the a two-year period, thereby doubling their profitability. Cow production has increased by 2,000 pounds per cow, feed inventory has increased, herd size has increased, heifer numbers have dramatically increased, housing for animals has improved, animals are healthier, and quality of life is greater with a vacation this past year for the farm family.
- A single visit with a farmer led to changes in milking procedures resulting in a 1,000 pound per day increase in production, translating to \$115 per day or \$3500 per month income, with no change in labor or other costs. Feed costs increased, but otherwise a nearly clear profit was realized of approximately \$2,200 per month.
- A farmer changed heifer growing operation such that they should realize a five-fold decrease in mortality rates (from 15 to three percent).
- Work with a farm led to changed practices by the farmers to raise their own heifers, utilize excess feed inventory, increase herd production, and utilize pasture management programs. The changes over a 2.5 year period show a 242 percent increase in net worth, change in quality of life for family, and increased average herd size.
- A 500-cow dairy operation is now using balance sheets and budgets for the first time.
- Two farms are utilizing the team to consolidate loans, refinance, and transfer ownership.

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

**Scope of Impact:** State Specific

**Goal 1**

**Key Theme:** Agricultural Profitability  
Small Farm Viability  
Organic Agriculture  
Diversified /Alternative Agriculture

**Issue:** Organic milk production is the fastest growing agricultural sector in New England. The on-farm price of 'conventional' milk has had tremendous highs and lows in the past 5 years. A steadily growing demand for organic dairy products is creating a market with stable prices for dairy farmers who decide to ship organic milk. Organic milk appears to be a way to bring more cash into the farm without increasing the herd size. Organic dairy farms now account for 8.5 percent (105) and 18 percent (63) of dairy farms in Vermont and Maine, respectively. The retail market is growing at 20 percent per year. But is organic dairying profitable?

**Activities:** Working with the University of Maine, UVM Extension and the Northeast Organic Farming Association of Vermont (NOFA-VT) partnered to lead the first, and largest, multistate study to date, measuring the profitability of organic dairy farming operations. Researchers collected 2004 and 2005 data from 30 organic dairy farmers (13 VT farmers and 17 ME farmers) who averaged 48 cows, sold 14,060 lbs of milk per cow at \$22.97 per cwt while production cost was \$22.58 per cwt.

Results from 2004 showed that, on average, organic dairy farms had a positive cash flow. However, after including economic costs for depreciation and the owner's labor, the average return on equity was a disappointing -3.0 percent. On-farm organic milk prices had been about \$20/hundredweight for several years, even as farm costs were increasing. Now, with three buyers of milk and the results from this study, the on-farm base price is about \$26/cwt. Combining year two results reinforces these effects, indicating that on average, organic dairy farms had a negative return on equity. Only one third of the farms were profitable.

Organic dairy farms were compared to conventional dairy farms with fewer than 90 cows as published in Farm Credit's Northeast Dairy Farm Summary. The average conventional dairy farm had higher net farm revenue, higher net revenue per cow, and higher net revenue per hundred-weight in 2004. However 2004 was unusual because of record high milk prices while organic profitability was declining.

The study found that the average organic dairy farm did have a taxable income but was not profitable enough to provide an adequate return for the owner's labor and no return on the farm's investment in cows, land, and equipment. Second, the study confirmed that profits for organic dairy farms declined 42 percent since 1999. This finding supports farmers' claims that profits were down and a higher milk price was needed. Third, this study found that with record high milk prices, conventional farms did better than the average organic dairy farm in 2004. But when

this was not the case (in 2003), organic dairy farms had nearly identical net farm revenue as conventional dairy farms.

**Impact:** This study confirmed that Northeast organic dairy farmers were receiving the same prices in 2004 as in 1999 while production costs increased by more than 40 percent. As a result, this study found profitability was down, costs up, and the average farm had a negative net farm income and return on equity. The results of this study were used to justify a higher organic milk price that was delivered to farmers in late 2005. The results of this study benefited the numerous dairy farms in transition to organic, current organic dairy farms, and conventional dairy farms thinking of transitioning to organic.

Results have since been published in every major dairy publication, presented at conferences, been published in major newspapers (e.g., Boston Globe, New York Times, Seattle Times), and been broadcast on the Paul Harvey show. The timely study provides important benchmarks for the cost of producing organic milk for farmers, Extension specialists, and lenders to use for comparisons and for budgeting. Study results have increased public awareness about the organic dairy farming business much more than was anticipated prior to the release of the research.

**Sources of Federal Funds:** Hatch, Smith-Lever 3(b) + (c), CSREES, State (University Matching Funds), Special Research Grants

**Scope of Impact:** Multistate Research -- VT, ME

## National Goal Area 2

**Overview:** During FY 2006 UVM Extension and VT-AES efforts and resources were further integrated to improve the safety of Vermonters. UVM Extension and VT-AES contributed 4.4 FTEs, or seven percent of total effort, toward National Goal Area 2, budgeting \$599,966 in federal and state funds toward projects in this area. During FY2006, VT-AES initiated or continued six research projects, and UVM Extension made an estimated 505 direct contacts and 300 indirect contacts. Of direct contacts, 33.9 percent were youths and 4.2 percent represented ethnic minorities. The ethnic minority with the highest number of contacts was Hispanic, with 1.78 percent of contacts self-reporting in this group. To accomplish most work in NGA 2, UVM targeted underserved groups, such as low-income individuals and families and rural agricultural workers, as well as vulnerable groups, such as seniors and young children.

UVM is helping Vermont lead the way as the farmstead cheesemaking Mecca of New England. Scientific research leads the craft as researchers:

- provide technical assistance to Vermont artisan cheesemakers to improve product safety, consistency and quality;
- identify causes and prevent growth of undesirable crystals on Cheddar cheese; and
- develop a sensory evaluation process for Mozzarella cheese produced from water buffalo milk.

UVM also works to reduce foodborne illnesses, estimated to affect more than 33 million people annually, with associated costs estimated between \$10 to 83 billion per year in medical, legal expenses and labor losses. Over the past ten years UVM Extension personnel have:

- helped more than 1,909 current and aspiring workers in the food business to achieve food safety certification from nationally recognized certification programs, with 175 reached during FY2006;
- improved school sanitation practices for 4,080 students and 23 schools through youth and adult-oriented workshops, school-base and county fair-based outreach efforts, with more than 300 reached during FY2006;
- assisted more than twenty food processing and handling businesses develop and implement HACCP plans; and
- expanded safety efforts to improving day care centers around the State.

UVM helps low-income individuals secure access to safe and healthy foods. During the past tens years UVM has initiated a Farm to Table program, providing fresh produce from local farms on a weekly basis to meal sites reaching more than 500 low-income people in Central Vermont weekly. A focus group was conducted with eight older adults at the Montpelier Senior Center to learn about their experiences with, and perceptions of, the Farm to Table program.

## Goal 2

### Allocated Resources

#### Research:

Hatch Funds:	\$139,447
All Funds:	\$369,713
FTE's:	3.0

#### Extension

Smith-Lever Funds:	\$ 60,458
All Funds:	\$230,253
FTE's:	1.4

## Goal 2

**Key Theme:** Food Safety  
Youth Development

**Issue:** More than 76 million persons become ill from foodborne pathogens in the U.S. each year, with as many as 5,000 resulting deaths. To reduce these numbers, food safety education efforts need to be targeted at not only adults, but school children, as well. The typical middle school grades offer the best opportunities to integrate food safety education into the curriculum, while simultaneously contributing to satisfying national and state education standards in science, technology, and family and consumer sciences. The Internet and the rapidly expanding capabilities of the World Wide Web offers the opportunity to deliver engaging, content rich, learning materials to rural communities that may not have the resources and/or faculty with the necessary expertise to provide a high-quality food safety educational program.

**Activities:** UVM researchers and outreach specialists developed a highly interactive, multimedia, self-paced online resource for delivering an established food safety curriculum to middle school children, and are now in the process of testing the effectiveness of this program with approximately 500 middle school children from around the country. The effectiveness will be determined using validated cognitive and attitudinal evaluation instruments. Researchers are also measuring student learning styles and comparing student attitudes and cognitive gain with individual learning styles. Five-hundred middle school children are currently using the UVM - developed interactive, multimedia, self-paced online resource tools and utilizing a UVM-created online learning environment that can be applied to helping students learn any number of different topics. Researchers are identifying and exploiting those aspects of information technology that have the greatest potential for use in a learning environment.

**Impact:** This project will provide a template for teaching other topics through an engaging and stimulating Web-based application. Focusing on the topic of food safety in middle school children is particularly important. In a few years, many of these students will be working in the food service industry. In addition, at this age, many students are beginning to make their own food preparation and purchasing choices. As a result, it is essential that they possess the necessary food safety skills and knowledge to make healthy and safe choices

**Sources of Federal Funds:** Hatch and Smith Lever (b) and (c)

Scope of Impact: Multistate Extension (national)

## Goal 2

**Key Theme:** Food Safety  
Foodborne Pathogen Protection  
Food Handling

**Issue:** Each year more than 76 million people in the United States suffer from foodborne illness, with approximately 5,000 people dying from complications. Foodborne illnesses are caused by eating food containing harmful bacteria (or toxins produced by bacteria), viruses, or parasites. When these pathogenic organisms come in contact with the food we eat, they can make us sick.

**Activity:** The Good Agricultural Practices Project focused on how to best educate home gardeners regarding proper integration of food safety principles into planting, harvesting and post-harvest handling of produce, thereby reducing the risk of pathogenic contamination of fresh fruits and vegetables. Significant progress was made toward completing program objectives during FY2006. Project directors met three times to discuss all aspects of program outreach and research efforts, and to coordinate timeline expectations. RI and CT project directors completed the design of on-site structured questions, guide and script to interview process, and Master Gardener volunteer interview training. The goal of on-site interview was as a follow-up, in-depth probe to the regional survey of home gardeners that assessed food safety knowledge and attitudes from garden to table. The interview questions focused on low knowledge areas throughout growing/harvesting and post-harvest handling as identified by the regional questionnaire. A PowerPoint presentation was developed along with role-playing scenarios for use during the training of Master Gardeners in each of the participating states.

Ninety-four interviews were successfully completed in the five states over the gardening season: CT/18, NH/19, ME/20, RI/18, VT/19. This fell slightly short of the 20 per state that the original protocol had specified. The interview process also took longer than anticipated with results not fully completed or received until late fall. Results from all interviews were tabulated by state. At the direction of the evaluator, the project directors met and assessed the questions of all those interviewed and identified themes and supporting evidence for each theme for each question. All the data were compiled and summarized for all the states for the individual questions.

Key findings indicate that:

- home gardeners knew they could become sick from produce but did not seem to understand that contamination by harmful bacteria on home grown fruits and vegetables could come from a variety of sources such as soil, compost, fresh manure and/or water supply;
- many gardeners felt that they used organic practices to grow produce since they considered it to be safer from a chemical perspective, but did not connect microbial issues with organically grown products;
- the majority of those interviewed would wash produce in very cold water believing that this helped preserve texture and freshness, but would also eat produce right out of the garden; and
- many practiced composting, but do not use temperature to determine completion.

**Impact:** Using interview results to inform the data obtained by the regional survey, project directors have begun designing outreach programming focusing on garden-to-table food safety areas where there is the greatest degree and likelihood of misunderstanding. Each project director is writing in one of the key food safety areas as identified by the survey and structured interviews. An abstract for the results of the consumer survey was accepted and presented as a poster session at the 2005 Institute of Food Technologists Convention, Cooperative Extension Division.

**Activity:** The Food Safety and Sanitation education project consists of a series of workshops that ranges from two to ten hours of Food Safety and Sanitation instruction and skill building, targeting youths and adults, as current and future food service workers.

**Impact:** UVM Extension personnel reached total of 153 youth and adult, current and future food service workers. Ninety percent of those attending classes passed tests following the workshops demonstrating their knowledge gains and offering them food service credentials. All students identified practices they will alter and adhere to, and many stated they, “talk about the class with each other and remind each other of the right way to do things.” One stated, “It will help me to help my cooks at work understand the different cooking temperatures for foods; showing how time and temperature is really important.”

UVM Extension is working with program advisors to focus on future programs affecting at-risk audiences, especially school children, based on Public law 108-265: The Child Nutrition and WIC Reauthorization Act. UVM Extension is seeking to take a role in carrying out food safety workshops to assist school districts in complying with this law.

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

**Scope of Impact:** State-specific

## Goal 2

**Key Theme:** Food Handling  
Food Safety  
Food-borne Illness

**Issue:** Serious complications associated with foodborne illness are more common among children under five years of age, elderly persons, and the chronically ill. According to some studies, diarrhea is 30 percent more common in children who attend child care programs than those cared for at home, and child care providers have higher rates of diarrheal illness than people who do not work with children. This is likely due to contamination as the result of the “fecal/ oral” that occurs when food safety practices such as frequent hand washing are ignored. For example if a person is responsible for changing diapers, caring for sick children and feeding the children and does not practice good personal hygiene the illness will result. For these reasons it is critical that child and adult care providers use research based food safety practices in their facilities. Child and adult day care facilities differ from other food service establishments in that they have “home” kitchen facilities, appliances and equipment, rather than a commercial grade facilities and appliances. Therefore the state health regulations for child and adult day care facilities can differ from those that apply to large health care facilities, schools or restaurants.

**Activity:** UVM Extension personnel initiated a program aimed to aid child care centers by presenting a five-hour Food Safety and Sanitation workshop to the staff of the Milton Head Start. Curricula used for school and institutional food services were not appropriate for this audience due to the differences in regulations, facilities, people served (toddlers and preschool children) and staff profiles. Therefore, staff adapted and implemented a curriculum developed by the University of Nebraska entitled “Food Safety Works”.

### **Impact:**

- All workers reached at the Head Start program “strongly agreed” that they would make multiple changes to their practice and/ or their facility to improve safety and health for ten full and part time staff members and eighty children.
- UVM Extension has been asked to present the program to over 125 child and adult care providers.
- UVM Extension was asked to present a two-hour version of this workshop to 45 directors and day-care coordinators of the Child and Adult Day Care Programs in Vermont sponsored by the Vermont Department of Education.

With this response, this program is now poised to assist more daycare centers in meeting age-appropriate safety guidelines.

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

**Scope of Impact:** State-specific

## Goal 2

**Key Theme:** Food Quality  
Foodborne Pathogen Protection  
HAACP

**Issue:** 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.

**Activity:** UVM Extension and VT-AES provided outreach assistance to this audience through consulting and site visits by an outreach specialist.

**Success Stories:** Without HAACP plans Vermont food processors cannot sell products out of state.

- For one processor, who completed a HACCP plan this past year, this meant the difference between having a business, as their major buyer accounting for 35 to 50 percent of sales, is in California, or not.
- 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 client needed assistance meeting compliance levels for allowable pathogenic bacteria in a raw product. This company was helped via numerous site visits and in aid 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.
- For one client, information saved them approximately \$800 to \$1500 per phone consultation.

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

**Scope of Impact:** State-specific

## Goal 2

### **Key Theme:** Food Quality

**Issue:** Vermont is a national leader in the domestic artisan cheese industry, with a growing collection of awards from national and international groups like the American Cheese Society and a high profile in the national media. UVM recently launched the Institute for Artisan Cheese -- the first organization in the country dedicated to providing professional education, research, technical, food safety and marketing support to makers of hand-crafted cheese -- funded by the John Merck Fund, a private donor, and the State of Vermont, through the efforts of then-senator James Jeffords (D-VT). The institute's mission focuses on education, research and outreach, ranging from a series of courses for beginners to the Master Artisan Cheesemaker Program, designed for experts.

One example of an important research contribution of the institute: calcium lactate (CL) crystal formation is a widespread and costly problem for Cheddar cheesemakers in Vermont and throughout the US because institutional buyers and consumers reject cheeses that contain the white surface deposits. Incidence of CL crystallization has increased substantially since the 1980's. Progress towards preventing crystal formation has been stymied because key analytical methods, especially quantitative methods to measure crystal growth rates, are currently lacking. This project seeks to develop a computer-vision image analysis method to quantify calcium lactate crystals on Cheddar cheese.

**Activity:** UVM has made significant progress towards understanding some of the causes of CL crystals. Researchers have developed a computer-vision image analysis method to quantify and characterize calcium lactate crystals on cheese surfaces. The data suggest that within-vat variation in salting efficacy may influence calcium lactate crystal formation.

The research program is tackling the most challenging issues facing the booming industry, such as examining the food safety implications associated with the 60-day aging rule for raw-milk hard cheeses, and determining appropriate quality measures for high-volume cheeses, such as mozzarella. The institute also utilizes national and international collaborations that faculty have established with colleagues in Ireland, Italy and France.

**Impact:** This research is helping UVM to unravel the mechanisms of crystal growth, and the specific conditions that accelerate the crystallization process. The ultimate goal is to develop effective crystallization preventive strategies. Results have the potential to enhance the quality and value of the more than 3 billion pounds of Cheddar cheese produced annually in the U.S. A thriving artisan cheese industry could make a key contribution to the Vermont state economy, according to industry expert Jeff Roberts, leader of the Vermont chapter of Slow Foods USA and a consultant to the institute. "In a small state like Vermont, value-added agricultural products make a lot of sense, especially given the state's reputation for quality," he said. "Vermont's proximity to major markets, from Boston to Washington, also positions the state's artisan cheesemakers well for success."

**Sources of Federal Funds:** Hatch

**Scope of Impact:** State-specific

## Goal 2

**Key Theme:** Food quality

NGA 1: Agricultural Profitability  
Biotechnology

**Issue:** The cause of maple syrup off flavors has not been unidentified and can occasionally affect a large proportion of the total maple syrup produced in a season, affecting millions of gallons of syrup. The goal of this project is to determine the compound(s) causing the metabolism off flavor in pure maple syrup. In addition researchers hope to explore environmental and/or maple syrup production factors that may influence the presence and intensity of metabolism, to determine whether researchers can predict the occurrence of the problem, or minimize it when it is found. Characterization of the amino acid and phenol components that influence the development of the metabolism off-flavors in maple syrup may provide insight to where and when the metabolism of off flavors might occur and allow for the development of a method or strategy to eliminate or reduce the problem.

**Activity:** Researchers are determining causes of off-flavors in maple syrup production, that in some seasons affect millions of gallons of syrup. They first characterized the amino acid and phenol components in the development of the metabolism off flavors in maple syrup, then analyzed 120 samples by High Performance Liquid Chromatography and Gas Chromatography/Mass Spectrophotometry for the presence and quantity of amino acid and phenolic flavor-forming compounds, next analyzed samples of the sap and syrup produced that tend to be prone to the presence of metabolism off flavors, and finally, determined common factors such as environmental (elevation, exposure, proportion of sugar to red maple) and production factors (collection method, vacuum level, use of reverse osmosis, evaporator boiling rate, use of processing aids) that might contribute to off flavors.

**Impact:** Researchers have identified the major component contributing to maple off-flavor as 2, 5 dimethylpyrazine. This finding provides the basis for developing technology to further enhance the quality of Vermont syrup without sacrificing its integrity as “pure Vermont maple syrup.”

**Sources of Federal Funds:** Hatch

**Scope of Impact:** State Specific

## Goal 2

**Key Theme:** Food Accessibility and Affordability

**Issue:** Underserved Vermonters of all ages consume fewer fruits and vegetables than are recommended in the Dietary Guidelines for Americans. Vermont seniors need improved access to fresh produce to reduce food insecurity. The "Community Farm Partners" project has multiple efforts underway aimed at increasing locally grown fruit and vegetables by Vermont's more vulnerable populations.

**Activity:** The Senior Farm Share program provides fresh produce to older adults living in 36 subsidized housing sites across the state. An associated Farm Share Nutrition Education program paired seniors with organic farms in order for seniors to have access to fresh produce during the growing season. Program partners included Northeast Organic Farmers' Association of VT, VT Dept of Health, and UVM Extension. UVM Extension provided nutrition education on the nutritional value of vegetables and ways to prepare foods for 72 participants from 10 sites in three counties.

**Impact:** For the 281 older adults who participated in the Senior Farm Share program this past season, and who completed both pre- and post- surveys (52 percent response rate), more than 80 percent of respondents stated that the fresh produce was fresher, tastier, and looked better than the produce they can access from other sources. Thirty-four percent of respondents stated they planned to cook more vegetables as a result of the class.

**Success Stories:** Quotes from participants involved in the Farm Share Nutrition Education program include the following:

- "As far as buying fruit, I've been buying more fruit this summer... There's been more melons and I always have one fruit a day, or two. But, I've been eating ... three a day with the program."
- "There is the socialization. It's fun almost. And some folks who missed out on signing up... missed it all."
- "This program... I think it opens a person up a little more. OK, now you got it, what are you gonna do with it? [cooking differently] [As a] last resort I'll find a neighbor who can use it..."

At one Senior Center eleven participants used the Healthy Eating Self-Test to establish a baseline for discussion of foods and amounts needed. Most participants showed a need to increase fruits, vegetables and whole grains to adequately meet their MyPyramid calorie requirements and recommendations. The class met preceding lunch, so that participants prepared their lunch for that day, and enhanced their daily nutritional requirements by preparing some new foods to them (kale and couscous), using whole grain products (whole wheat pastry flour), and increasing fruits and vegetables (tried new recipes that used more vegetables or fruits). While many gains were noted, the one most commonly cited was learning about the importance of increasing fiber in their diets, and having practice actually doing it.

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

**Scope of Impact:** State Specific

**Activity:** The Farm to Table program provides fresh produce from a local farm on a weekly basis to meal sites for low-income people in Central Vermont. A focus group was conducted with eight older adults at the Montpelier Senior Center to learn about their experiences with, and perceptions of, the Farm to Table program.

**Impact:** More than 500 people each week received fresh fruit and vegetables through the program, during Vermont's five-month fresh-produce season. Focus group results indicate that participants repeatedly mentioned the wonderful quality of the produce. This is a statement from one of the participants: "We've had watermelons that are just out of this world. [The farmer] did a beautiful job. To grow watermelons in Vermont is really something because they don't usually come up very good. It was just really out of this world. Who needs candy when you can have things like that?"

Another participant spoke of the differences between the food she has at home, and the food at the Senior Center. She said "I do have vegetables at home, but sometimes I won't eat [them]. But here, if she has lots of vegetables that are good, I know I'll eat them."

All focus group participants made it clear that Farm to Table made an important and positive contribution to their food intake, as well as to their morale.

Sample comments about the Farm to Table program made by two food service coordinators at meal sites include:

- "It was a godsend for not only our program, but for the tenants who reap the benefits of our success."
- "We really like it. People come here that don't eat many vegetables at all. The chance to feed them fresh vegetables was really good. I didn't know too much about people's food preferences before this program, but I found out that a lot of people really liked mashed turnips, and squash. Everybody loves beets. I hadn't realized that people love winter squash."

Educators submitted two new SARE proposals designed to help increase understanding of the food system and access to Vermont's local produce.

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

**Scope of Impact:** State Specific

### National Goal Area 3

**Overview:** During FY 2006 UVM Extension and VT-AES efforts and resources were further integrated to improve the health of Vermonters. UVM Extension and VT-AES contributed 5.3 FTE's or eight percent of total effort, toward National Goal Area 3, budgeting \$921,201 in federal and state funds toward projects in this area. During FY2006, VT-AES initiated or continued eight research projects, and UVM Extension made an estimated 138,400 contacts, with 12,498 direct contacts and 125,962 indirect contacts. Of direct contacts, 45.2 percent were youths and 4.2 percent represented ethnic minorities. The ethnic minority with the highest number of contacts was Hispanic, with 1.78 percent of contacts self-reporting in this group. To accomplish most work in NGA 3, UVM targets underserved groups, such as low-income individuals and families and rural agricultural workers, as well as vulnerable groups, such as seniors and young children. UVM Extension worked with 237 volunteers, who contributed 1,972 hours of their time toward programming in NGA 3.

UVM assists adults and children to attain and maintain healthy weights. Currently 53 percent of adult Vermonters, or 226,615 adults, are overweight, and national childhood obesity rates have increased from eleven to 15 percent during the past decade. The percentage of obese adults in Vermont has increased 71 percent since 1990. Success at maintaining weight loss has not improved over this time. UVM Extension has developed outreach programs reaching more than 3,000 youth, an increase of 20 percent over last year, to improve dietary choices and to increase the proportion of non-processed food consumed. VT-AES studies have shown several important links between dairy consumption and health in children. VT-AES research has also developed a successful means of using the internet to help overweight people to lose weight and maintain healthy weights. UVM is researching root causes to epidemic obesity rates, including considerations of how cultural infrastructures and food-labeling policies may promote obesity and undesirable food choices. Researchers are carrying out three other research and outreach programs targeting obesity to:

- determine what nutrition information in restaurants promotes healthier food choices;
- develop and test an interactive, multimedia web-based learning environment for teaching food safety to middle-school children; and
- create a web-based, energy-balance, interactive learning tool for young adults.

UVM also works to ensure individuals have access to nutritious, safe, acceptable, and affordable food supplies, lacking for an estimated 7.7 percent of households in Vermont. UVM programs target vulnerable populations, including low-income seniors, youths, low-income families, and families utilizing community food kitchens. UVM Extension 's EFNEP program, helping low-income families to make healthy, affordable food choices and learn home-cooking skills, utilized 129 volunteers to reach 175 adults and 1,185 (87 percent) youths, showing that more than 85 percent of participants improved food resource management and nutrition practices. Ethnic minorities represented eleven percent of adult and eight percent of youth EFNEP participants.

Over the past decade, youth program participants have donated more than 26 tons of fresh, local produce to food providers for income-limited families, with 1,685 pounds donated during FY2006 to local hunger relief programs and schools. This food has reached homes of more than 7,500 children under five years of age.

### **Goal 3**

#### **Allocated Resources**

##### Research:

Hatch Funds:	\$ 58,263
All Funds:	\$320,480
FTE's:	1.8

##### Extension

Smith-Lever Funds:	\$ 157,733
All Funds:	\$ 600,721
FTE's:	3.5

### Goal 3

**Key Theme:** Human Nutrition

**Issue:** Currently almost 70 percent of the US population is overweight or obese, and obesity rates have almost doubled over the past two decades. With as many as 400,000 Americans dying in 2000 due to “poor diet and physical inactivity,” obesity is on track to overtake tobacco as the largest cause of preventable death. The FDA reports that our nation is currently facing a major long-term public health crisis that shows no signs of abating. UVM researchers and outreach specialists are working on assisting people to prevent people from becoming obese, and to help those who are obese to lose weight and maintain weight loss. Effective interventions are expensive, intensive and not widely available. Also, while average weight losses produced with behavioral techniques have increased by approximately 75 percent over the past 20 years, similar improvements in the maintenance of weight loss have not been realized. Significant amounts of energy are being targeted toward improving the long-term maintenance of weight loss. It seems that novel approaches are needed to keep subjects engaged and involved in interventions over a longer period of time. Also, much speculation, but little controlled research has been conducted to examine the roots and underpinnings of systemic societal trends causing epidemic increases in obesity. Several avenues of researcher and outreach are being pursued:

- a) The use of the Internet may provide an option for reducing the patient burden associated with perpetual clinic visits. There is currently limited evidence that computer-based technologies can be used to support behavior change efforts. This is particularly true for obesity treatment.
- b) Research was carried out to synthesize and estimate a model of the relationship between the food system and obesity.

**Activity:** The purpose of one project (ending FY2005) was to determine if weight loss achieved by participating in an on-line behavioral intervention could be improved with periodic in-person support. More than two-hundred participants in the on-line only program lost an average of approximately 20 pounds over six months, and there was no benefit found by adding periodic in-person support.

A second investigation set out to test a novel approach to sustaining long-term contact with individuals after participation in a structured behavioral weight loss program. For the second study (ending FY2006), researchers recruited 255 overweight and obese adults to participate. All subjects took part in an identical six-month behavioral weight control intervention conducted over interactive television. Following weight loss, subjects were randomly assigned to one of three weight maintenance conditions: 1) Internet support; 2) frequent in-person support; 3) minimal in-person support. All subjects were seen for assessment measures at baseline and at 6 months, 12 months, and 18 months. There were no significant differences among the three groups in terms of average weight lost per person from baseline to 18 months. These results suggest that the Internet is a viable vehicle for delivery of an intensive behavioral intervention.

**Impact:** The use of the Internet to deliver weight-loss and weight-loss maintenance interventions can create an effective dissemination vehicle to facilitate obesity treatment for those who may

not have previously had access to behavioral weight-loss intervention programs. Participants assigned to an internet-based weight loss and maintenance program managed similar weight loss over 18 months when compared with face-to-face counseling. It appears that internet-based support is a viable means for promoting long-term weight loss and maintenance. Currently, UVM provides a low-cost program, as part of continuing research, to overweight adults in Vermont using internet-based meetings and on-line resources and tool-packs. Additionally, UVM Continuing Education has created a spin-off program utilizing the internet for wider audiences. Several programs in the area offer similar services to Vermont and national residents. The UVM program has reached more than 1000 people through their weight-loss programs over the past five years, losing over 20,000 pounds. Additional research is being conducted on weight loss and weight-loss maintenance through various combinations of media support options.

**Sources for Federal Funds:** Hatch Funding

**Scope of Impact:** State Specific

**Activity:** Researchers analyzed interview results from a geographically stratified random sample collected in 2004 as part of a national poll administered by the Center for Rural Studies. Telephone questionnaires were administered over a two week period by trained staff using a computer aided telephone interviewing system (CATI), resulting in a total of 605 surveys with complete data on all variables included in the reduced form analysis and 589 surveys for the structural equation estimates of overweight. Controlling for demographic characteristics, researchers found that the greatest contributors to reduced physical activity hours were:

- gender (lower rates found for women);
- having children in the household;
- aging;
- being hindered by an illness that limits activity; and
- having health insurance coverage (deserves further research).

Other results of interview analyses showed that the following:

- eating more than one fast food meal per week increases the probability of being overweight;
- leading a sedentary life as measured by increases in hours of television watched, increases the probability of being overweight;
- self reports of 'leading an active lifestyle' and 'always making healthy food choices' contribute to decreases in the probability of being overweight; increases in the number of restaurant meals that are not characterized as fast food does not affect the probability of being classified as overweight; and
- specific exercise regimes do not affect the probability of being classified as overweight.

**Impact:** Information is being published and shared with nutrition outreach specialists. Understanding the magnitude of the effect of various food system variables on overweight is aiding in the development of education and policy initiatives that can help stem the rising tide of obesity in Vermont and the United States. The final year of the project will consist of refining both the model and econometric specification and testing it on a 2007 national sample.

**Sources for Federal Funds:** Hatch Funding

**Scope of Impact:** Multistate- National

### Goal 3

**Key Theme:** Human Nutrition

**Issue:** Nationally, childhood obesity is on the rise and statewide, Vermont children do not eat enough fruits and vegetables. In addition, even in an agricultural state such as Vermont, children do not know where their food comes from.

**Activity:** UVM Extension outreach specialists working in the 4-H Growing Connections program have been training educators around the state to grow gardens with youth in an effort to address these issues, have revised the curriculum to reach youth at a younger age, have brought child care providers into the collaboration, and have helped to support the creation of gardens at these centers.

**Impact:** A qualitative analysis of 62 quotes and 108 observations compiled from youth participants and adult volunteers, respectively, elicited several themes:

- 6 percent of quotes and 39 percent of observations showed positive examples of participants developing *community and relationship skills*.
  - \* Sample quote from a youth, age 15: “ ... Donating food is like the best part (besides eating corn) because you feel good about yourself after knowing that you helped someone.”
  - \* Sample observations from adult volunteers: “Because of their work at the farmers’ market, they got better with their communication skills, too.”
- 31 percent of quotes and 32 percent of observations showed positive examples of participants developing *gardening and exercise skills*.
  - \* Sample quote from a 4-year-old explaining how to plant corn seeds: “You cover it with dirt so birds don’t eat it.”
  - \* Sample observation: “Through the summer, I saw their confidence grow and saw them become more comfortable with the garden. They learned so much about gardening and by the end could tell us everything that needed to be done instead of the adults leading everything.”
- 55 percent of quotes and 31 percent of observations showed positive examples of participants developing *food preparation and nutrition skills*.
  - \* Sample quote from a student, age 10: “I cooked the radishes up and ate them with my family.”
  - \* “I had kids coming towards the end to request specific plants for specific recipes, and complaining about the quality of other food in their lives.”
- 8 percent of quotes and 2 percent of observations focused on the *how much fun* the program was for participants.
  - \* Sample quote from a student, age 9, stated, in response to being asked how often she would like to attend Winooski Garden and Cooking Club, for the 2007 summer program, “Yes, eight hours a day, all day, every day all summer long.”
  - \* Sample observation: “The children were very excited to work out in the garden.”

**Success Stories:** One educator noticed a “rough” kid ...didn’t want to work hard at all... After 20 hours of service, he came back to volunteer and he was planting flowers with some younger

‘rough’ boys who looked up to him. He was teaching them to be careful with the plants and how to care for them.”

The father of a set of sibling participants personally thanked an educator for showing his children how to garden, and said that it really improved the way they got along with each other.

**Sources for Federal Funds:** Smith-Lever (b) and (c)

**Scope of Impact:** State Specific

### Goal 3

**Key Theme:** Human Nutrition  
Human Health

**Issue:** Approximately seven percent of the U.S. population has diabetes, In Vermont, one out of four Vermonters is believed to have diabetes, or pre-diabetes. Consequently, diabetes has been defined as a “premiere” condition in the Vermont Department of Health’s Blueprint project, indicating that resources need to be devoted in the coming years to address this significant issue. Diabetics have many concerns regarding nutrition, physical activity and stress. All of these issues impact their ability to maintain to take control of their blood glucose levels.

**Activity:** For a number of years, UVM Extension has worked collaboratively with dietitians and certified diabetes educators around the state to deliver Dining with Diabetes, a four-session nutrition, physical activity, and self-management program. Dining with Diabetes (DWD) programs focus on the nutrition and food aspects of diabetes control. DWD courses teach about carbohydrate (CHO) counting, sources of CHO in the diet and how to read a Nutrition Facts food label to calculate the amount of CHO in foods eaten. Dining with Diabetes has been extremely well received in communities, and has reached over 700 people since its inception, with the primary target population being older adults. With additional funding from UVM Center for Teaching and Learning, Extension’s three nutrition and food specialists recently revised the curriculum and supporting power point program that includes the latest research and findings related to diabetes, meal management, and physical activity.

**Impact:** Changes noted by participants have included healthier behavior changes that have resulted in decreased glucose levels, cholesterol, and weight. Participants are confident that they can plan and serve healthy meals for the diabetic while keeping track of total carbohydrates and other nutrients needed for good health.

Responses on evaluations of DWD classes also indicate that participants:

- now read labels, try new recipes, and feel better about their ability to plan nutritious meals for themselves and family members;
- pay much more attention to reading and studying food labels before purchase;
- found that what they learned about the component parts of a diet, using Nutrition Facts Labels to compare foods for fat, carbohydrate, fiber and sodium made shopping easier.

**Sources for Federal Funds:** Smith-Lever (b) and (c)

**Scope of Impact:** State Specific

### Goal 3

**Key Theme:** Human Nutrition

**Issue:** Although American diets in general are not meeting the recommended dietary guidelines, the average diet quality of people with limited resources is even lower than the general population.

**Activity:** The Expanded Food and Nutrition Education Program (EFNEP) is an integral component of Extension programming efforts. For 38 years, EFNEP has helped families living in or near poverty--especially those with young children--to acquire knowledge, skills, and changes in behavior to achieve adequate diets providing normal nutrition. EFNEP Educators, trained paraprofessionals supervised by nutrition professionals, provide in-depth education to adults and youth using a variety of hands-on methods, tailored specifically to meet the needs of limited resource families. Families are offered the opportunity to gain skills in food resource management, nutrition, and food safety practices. In 2006, EFNEP utilized 127 adult volunteers and two youth volunteers to reach 175 adults and 1,185 youths.

**Impact:** FY2006 data show that 87 percent of the 175 adult Vermont participants were enrolled in one or more food assistance programs. Adult education occurred in group (74 percent), individual (19 percent), and a combination of group and individual (7 percent) settings. The 1,185 youth addressed through EFNEP programs participated through a variety of settings: 67 percent (801 youths) participated through one of 42 short-term special interest programs and day camps; 22 percent (256 youths) participated through an overnight camp; 8 percent (95 youths) participated through one of eight school enrichment programs; 3 percent (28 youths) participated through one of three organized clubs; overnight camps; and 5 youths were individually mentored.

Evaluation results show that 56 percent of participants completed the program, with an average time to completion of 2.5 months, and 90 percent of non-completing participants continued in the program into FY2007. Evaluation data in Vermont shows that adult participants demonstrate statistically significant improvements in nutrition, food safety, and resource management practices, such as reading food labels and planning meals ahead of time. The programs yielded participant improvement in several behavioral areas:

- 86 percent of participants showed improvement in one or more food resource management practices;
- 89 percent of participants showed improvement in one or more nutrition practices;
- 59 percent of participants showed improvement in one or more food safety practices;
- 2.3 times as many participants demonstrated acceptable food resource management practices upon exit than upon entry (an increase from 18 to 41 percent);
- Nearly twice as many participants demonstrated acceptable nutrition practices upon exit (an increase from 27 to 46 percent);
- 83 percent of participants demonstrated acceptable food safety practices upon exit (an increase of 25 percent from entrance); and
- 4.5 times as many participants (an increase from 6 to 27 percent) demonstrated acceptable practices in all three of these areas upon exiting the program than upon

entering

Progress included:

- improved safety practices by thawing foods using the refrigerator or cooking, rather than leaving out at room temperature (50 percent);
- using the "Nutrition Facts" on food labels more often to assist them in making food choices (58 percent);
- improved food resource management practices by planning meals in advance more often (50 percent).
- One third of respondents stated that they ran out of food before the end of the month less often than before they had completed the workshops.

Multiple cost-benefit analyses highlight the value of EFNEP. A Virginia study found that for every \$1 invested in EFNEP, \$10.64 in benefits from reduced health care costs can be expected. An Iowa study showed \$8.03 in benefits; a consortium of six Midwestern states found \$8.82; and a smaller state, Oregon, had \$3.63 in benefits. Another study in Tennessee looked at food expenditures and found that for every \$1 spent to implement EFNEP, \$2.48 is saved on food expenditures. This reduces the need for emergency food assistance and saves money for other necessities. An independent study by the Produce for Better Health Foundation assessed how federal programs were addressing the gap between the current consumption patterns of fruits and vegetables and the recommended levels of intake. They found that EFNEP is by far the most effective federal program in increasing consumption of fruits and vegetables. EFNEP has demonstrated that effectively administered and well-funded nutrition education programs focusing on fruits and vegetables can make an impact.

**Success Stories:** A new, young immigrant male with limited income and cooking skills stated, "I was nervous when first coming to this class. I am so glad I did it as it has been a very worthwhile learning experience. I can now cook!"

One young man enrolled in the Pathway Program that serves students from income-limited families, related that he was visiting the culinary program at a technical school with plans to attend next year. He indicated he had learned so much from the classes he had attended and found that he really enjoyed cooking. With a big smile he said "I think I want to be a chef after having such a good time in your classes".

The mother of a student in one of the school enrichment programs stopped by to discuss the class with the teacher, reporting how thrilled she was with the excitement her son had shown in helping her in the kitchen at home. Not only was the student cooking new, healthy recipes but he insisted on helping with the shopping and menu planning. The mother reported there had been a big improvement in her son's attitude toward going to school since taking the EFNEP program.

**Sources for Federal Funds:** Smith-Lever (d)

**Scope of Impact:** State Specific

**National Goal Area 4**

**Overview:** During FY 2006 UVM Extension and VT-AES efforts and resources were further integrated to improve the quality of Vermont's natural environment. UVM Extension and VT-AES contributed 13.8 FTEs, or 21 percent of total effort, toward National Goal Area 4, budgeting \$2,022,709 in federal and state funds toward projects in this area. During FY2006, VT-AES and UVM Extension initiated or continued 53 research projects, and UVM Extension made an estimated 24,030 direct contacts and 397,800 indirect contacts. Nine percent of direct contacts were youths and 1.8 percent represented ethnic minorities. The ethnic minority with the highest number of contacts was American Indian, with 0.62 percent of contacts self-reporting in this group. To accomplish most work in NGA 4, UVM targets underserved groups, such as low-income individuals and families and rural agricultural workers, as well as vulnerable groups, such as at-risk youth and children. UVM Extension worked with 299 volunteers, who contributed 2,086 hours of their time toward programming in NGA 4.

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 de-icers, 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 farmers, urban and rural residents, and commercial businesses in making choices that reduce contamination of waterways. Within one year, programs have helped:

- 480 of 500 households bordering an urban brook to implement low-input gardening practices;
- ten commercial property owners to implement a new low input program, saving between 0.45 and 0.91 metric tons of total phosphorous annually; and
- more than 3000 middle-school youth gain skills and knowledge about the water quality of waterways in their community, empowering students through the monitoring.

Whey, iron slag, caustic cleansers, animal manure and plastics are waste materials that pose threats to environmental quality. UVM is developing uses for waste materials as novel value-added products which are benign to the environment. Researchers have developed new strategies to reduce impacts of waste materials on lakes, streams and soils. VT-AES and UVM Extension have teamed up with farmers to:

- evaluate management practices to minimize phosphorus loss and surface runoff;
- develop on-farm projects to promote nutrient management strategies to improve water quality;
- use iron slag to reduce phosphorus and suspended solids from agricultural runoff;
- test alternative cropping systems to reduce accumulation of phosphorus load in agricultural soils;
- test a suite of environmentally benign agents for their ability to remove scale buildup from maple evaporator pans. This will obviate the need for acid-based cleansers;
- test recycled plastics from a variety of sources for their insulating and reflective capacities -- radiant manifolds are being tested for their ability to transfer heat from manure through greenhouse soils;
- use rain gardens in public and private settings to reduce storm-water impact; and
- develop incentives for making farm management decisions that reduce environmental impacts.

Research projects also test naturally occurring fungi or Integrated Pest Management and other nontoxic methods to thwart the onslaught of invasive exotic pests. For example entomologists and diagnosticians:

- use indicator plants to time pesticide applications to control thrips;
- develop low environmental impact, fungi-producing pest-management control spreading devices;
- assess the cold temperature tolerance of natural predators in hope of controlling infestation by hemlock woolly adelgid;
- assess chemical control strategies to prevent spread of the invasive viburnum leaf beetle.;
- develop standardized detection and monitoring plan to determine spread of hemlock woolly adelgid;
- develop and participate in a nationwide network of plant diagnostic clinics to facilitate rapid diagnosis of important pests and diseases, and limit their spread;
- limit the spread via import/export of exotic pests in tree fruit crops;
- assess the effect of genetically modified corn on soil insect communities;
- develop fungal biocontrol agents to address insect pests of worldwide importance;
- promote use of integrated pest management strategies;
- determine the genetic, molecular and physiological interactions occurring between legume plants and soil bacteria to improve soil quality without use of commercial fertilizers; and
- investigate the potential of biological control of the Asian long-horned beetle.

Several projects concentrate on plant and soil science in the face of rapid climate change and methods of measuring ecosystem impact as researchers:

- assess nutrient availability by evaluating soil animal community diversity;
- determine the effect of global climate change on nutrient availability in arid lands;
- study the evolutionary migration of a plant groups and uncover geography-based species development to provide insight into the sources and patterns of evolutionary diversity;

- through travel, collection and genome investigation, learn the ecological, geographic and edaphic context of a diversity of a plant genus in order to understand what disruption to that context has on this genus and perhaps others;
- evaluate the effects of polluted soils on soil animal communities; and
- model the long-term movement of phosphorus through Vermont watersheds; and
- measure the effect of global climate change on photosynthetic performance of plants.

## **Goal 4**

### **Allocated Resources**

#### Research:

Hatch Funds:	\$314,808
All Funds:	\$911,359
FTE's:	7.2

#### Extension

Smith-Lever Funds:	\$ 291,810
All Funds:	\$ 1,111,350
FTE's:	6.6

## Goal 4

**Key Theme:** Water Quality

**Issue:** 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.

Reducing nutrient run-off from farms has become a state priority by Vermont's governor. Farmers wishing to comply with regulations and reduce the negative impacts of farming on water ways also want to know how to develop their own nutrient management plans instead of hiring someone else to develop the plan for them. Arming farmers with information and skills to produce and implement their own nutrient management plans will increase farmer understanding of their current impacts and their plans, and will increase the investment and ownership farmers have in the plans, thereby increasing the likelihood of their successful implementation.

**Activity:** UVM Extension has been working with four communities by forming local collaboratives to design and implement locale-specific water quality education and protection strategic initiatives. Local community organizations, local high schools, and local officials have formed partnerships to inform and educate watershed residents about water quality protection. By working with groups to determine site-specific priorities for improving water quality, communities can better identify and focus efforts to magnify success.

The Englesby Brook watershed, in Burlington, Vermont, is currently draining excess phosphorous into Lake Champlain. While previous education measures targeted residents of the watershed, non-residential properties comprise 23 percent of the watershed area. To address excess phosphorous levels measured in, UVM Extension personnel conducted low input/no phosphorous education classes for commercial and institutional property owners. While FY2005 focused on results from the previous year's work with neighborhoods surrounding an urban-impacted brook, FY2006 emphasized evaluation of work done over the past two years with businesses.

**Impact:** One year after a neighborhood organization formed, 480 of 500 households bordering the brook have implemented low-input gardening practices. Another city group successfully applied for a grant to conduct a survey that will be used to develop targeted neighborhood water quality education efforts. A pre-post survey of commercial participants shows that of the 42 priority non-residential properties (based on total landscaped area and intensity of landscape maintenance):

- UVM Extension successfully reached 35 commercial properties (83 percent);
- 18 (43 percent) agreed to participate in the educational program;
- 10 property managers agreed to implement a low input program, an adoption rate of 29 percent;

- Low-input adopters are responsible for 20 of the 42 priority parcels, totaling 47.04 acres (59 percent) of total commercial lawn area in the watershed;
- 2 private lawn care firms also adopted low input practices to increase profitability
- between 0.45 and 0.91 metric tons of total phosphorous savings were achieved annually, based on information on prior fertilizer use.

The annual phosphorous reduction target for the entire Lake Champlain watershed is 81 metric tons. UVM Extension personnel are currently analyzing PO<sub>4</sub> concentrations data from a water quality monitoring program in the watershed to determine if water quality in the brook improved. UVM Extension personnel also co-edited a Shoreline Stabilization Handbook for Lake Champlain, and will be a feature article in *Coastal Services*, a national trade journal for coastal resource managers published by the NOAA Coastal Services Center.

**Activity:** During the fall of 2005 a nutrient management curriculum for farmers was developed in collaboration with NRCS. A course was planned to deliver the information to farmers in five three-hour classes.

UVM Extension, in conjunction with the Vermont Agency of Agriculture, planned a field trip for farmers, and industry and agency representatives, to visit Quebec and learn about farmer, researcher, and provincial projects to reduce the impacts of agriculture and water quality occurring there. Seven farmers and ten agency/industry representatives attended.

**Impact:** Results of farmer course participants indicate that:

- 100 percent understood their nutrient management plan very well
- 100 percent would be able to implement their plans;
- 75 percent would save money on fertilizer by implementing plans;
- The 25 percent who said they would not save money on fertilizer responded that current fertilizer application rates met compliance standards; and
- 100 percent felt that by implementing their plans they would have a positive impact on surface and groundwater quality.

Since the workshop, participating farmers have:

- taken their first manure samples without being reminded;
- been attentive to where they spread manure or fertilizer, and how much;
- gone beyond requirements of the Nutrient Management Plan by requesting nitrogen tests be done on their corn fields each Spring, to determine whether sufficient nitrogen exists, thereby eliminating or reducing additional fertilizer or manure applications; and
- all persisted in following their nutrient management plans, even in this poor crop year.

One of the farmers worked closely with the custom spreader to calibrate his tank. It is a success to see these farmers carrying their Nutrient Management Plans in their trucks instead of stored away in their filing cabinets.

Seven farmers and ten agency/industry representatives attending the Quebec fieldtrip learned about Quebec's Environmental Clubs. The Environmental Clubs were developed and run by farmers to help each other meet regulations through education, research, and implementation of various practices. The clubs are funded by provincial, commodity, and farmer dollars. Upon our

return attending farmers were so excited about forming a Vermont Environmental Club that educators held a small debriefing meeting to discuss the possibility. From this meeting farmers have:

- begun to form the Vermont version of the Quebec Environmental Club;
- held 3 meetings;
- attracted 30 farmers to join;
- elected a board;
- developed a mission statement & bylaws; and
- begun drafting proposals to hire an agronomist.

The farmers feel the power of their organization and are dedicated to increase numbers so all farmers in the Franklin/Grand Isle County Farmers Watershed Alliance can improve their farms to protect the air, soil, and water in the Lake Champlain Basin. According to many of the farmers in the group, this is the first time dairy farmers have been able to unite as a network to proactively address water quality issues. They have stated many times not only the environmental benefits they can acquire from such a network but also social and even economic benefits.

**Activity:** UVM Extension worked to develop non-point-source nutrient management controls in three priority watersheds within the Lake Champlain Basin because of negative environmental effects. UVM Extension, through the Center for Sustainable Agriculture staff and volunteers, continues to work with the USDA-NRCS State Technical Committee and EQIP Subcommittee to address this issue. The Vermont Pasture Network received \$39,000 grant from Vermont's DEC-ANR to continue enhancement of their Grazing for Water Quality Initiative. With the help of farmers, the Pasture Network developed a grazing information manual distributing targeted information directly to 170 farms in the Otter Creek, St. Alban's Bay and Missisquoi watersheds. Of these 170 farms, twenty-two farms, representing 3,939 acres of owned and rented farmland received direct on-farm technical assistance.

**Impact:** The work being conducted on 22 farms with 1,870 dairy cows and 178 small ruminant animals, has improved sustainable practices on 2,877 acres of crop, hay, and pasture in Vermont that affect the following lake watershed: lake watersheds involved include the St. Albans Bay and its tributaries of Jewett Brook, Stevens Brook, Rugg Brook, and Mill River; the Missisquoi Bay and its tributaries of the Missisquoi River, Rock River, and Pike River; and, the Otter Creek Lake Segment and its tributaries of Otter Creek, Little Otter Creek, and Lewis Creek. Specific practices involve the development of nutrient management plans, a reduction in the use of manure to fertilize fields after soil nitrogen tests and grassland pasture grazing that reduces lake polluting inputs.

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

**Scope of Impact:** State Specific

## Goal 4

**Key Theme:** Water Quality

**Issue:** Vermont schools historically lack support for science-based watershed and water quality education.

**Activity:** The UVM Extension-sponsored Watershed Alliance (UVM-WSA) assists teachers and students to learn 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:**

In addition to coordinating more than 60 watershed education and monitoring sessions since 2002, with more than 1,700 students covering 40 streams and waterways within eleven watersheds of Vermont, the Watershed Alliance strengthened watershed education programming in the State by focusing on teacher education. Outcomes include the following:

During the 2005/2006 school year, 1,168 fifth through twelfth grade students in 17 schools participated in the the University of Vermont Watershed Alliance (WSA) Watershed Education and Stream Investigation programs, including five alternative education programs targeting non-traditional students with learning or behavioral disorders, and homeschool students. A total of 11 students from the Rubenstein School of Environment and Natural Resources (RESNR) worked as Watershed Educator interns in FY 06. All students who participated in the program showed a substantial increase in water quality knowledge. Of students participating in the WSA program, 87 percent stated they will change their behavior in the future to protect water quality, and correctly identified at least two ways to do so.

An on-line tracking system that can be used by all volunteer water-quality monitors in Vermont has been developed – students have been entering data since 2005 during Watershed Alliance stream monitoring field trips online from any computer using their school password, and any person with internet access can view data, so schools can compare their work with others' work around the state ( [www.vtwatergateway.org](http://www.vtwatergateway.org) )

The Watershed Alliance program was highlighted in the recent Vermont Department of Environmental Conservation publication titled "Vermont Volunteer Surface Water Monitoring Guide". The guide listed the Watershed Alliance as a leading water quality education and monitoring program in the state. The guide also listed the Vermont Water Quality Gateway as the only online water quality database for use by students in the state.

Other projects now underway as this program expands include the following:

- An EPA funded project to develop and test a locally-specific middle school watershed curriculum in Burlington. The pilot program was successfully completed in the spring of 2006, with four modules developed: The Physics of Stormwater, Bacteria and Human Health, Applied Watershed Chemistry, and Eutrophication and You. This fall, the

modules will be implemented in six classrooms in both Hunt Middle School and Edmunds Middle School. Watershed Alliance interns will assist with fieldwork.

- A partnership with Vermont Institute of Natural Sciences, Champlain Basin Education Initiative (CBEI), Adirondack Visitor Interpretive Center, ECHO at the Leahy Center for Lake Champlain, the Lake Champlain Basin Program, the Lake Champlain Committee, National Wildlife Federation, Shelburne Farms, Vermont Project WET, the University of Vermont Watershed Alliance, and Lake Champlain Sea Grant to offer several professional development workshops for educators.
- A collaboration with the Lake Champlain Basin to develop “Watershed for Every Classroom” program;
- Support provisions for graduate student Sacha Lozano in developing a Watershed Alliance integrated program (to be administered in the RESL Teaching Lab): Keeping the Balance in Lake Champlain: an Exploration of Lake Ecology and Human Activities
- Development of a Watershed Alliance integrated program for the Melosira Research Vessel, with the first of three school groups participating this spring.
- A partnership with Lake Champlain’s ECHO Center to strengthen ECHO-UVM connections.

**Success Stories:** Eighth grade students at a school with low Vermont standards tests scores (and in which 43% of students were eligible for free and reduced cost lunches) participated in a Watershed Alliance program. During the program, 105 student participants conducted a study of the Lamoille River. Students measured biological, chemical and physical aspects of the river, completed an outreach project in their school, educated fellow students about the importance of protecting water quality and wrote a letter to Governor Jim Douglas regarding water protection in Vermont. While working with an alternative student population in an urban high school, teachers observed that the at-risk students responded well to the Watershed Alliance. They reported that the students had not been engaged until participating in this program, and the students themselves responded by requesting more stream monitoring field trips with the Watershed Alliance. It is very rewarding ... as [these students] generally are "unreachable".

While Lake Champlain is very close to all of the schools in Burlington, students rarely get a chance to visit and learn about this important natural and cultural resource. The Urban Watershed Education Project addresses this problem by providing resources (through grant funding) and training for middle school teachers in Burlington to teach about watershed issues. The pilot project was successful in two classrooms in 2004 and 2005. During FY2007, the program will be expanded to include ten more classes at two elementary schools.

The Watershed Alliance program directly connects with academic content in several of UVM’s natural resources classes. Interns benefit from the opportunity to apply their academic knowledge to work in the field. Through leading workshops in various classrooms and settings, interns learn problem solving, collaboration, and to interact as professionals with clients. In addition, their service-learning experience with the Watershed Alliance is often the sole content-related work experience they gain in their four years at UVM. Interning with the Watershed Alliance is an important part of student work history. Several former interns have sent letters from their new professional positions, stating how important the experience was to obtaining their current jobs.

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

**Scope of Impact:** Multistate Extension (NY, VT)

## Goal 4

**Key Theme:** Agricultural Waste Management  
Biological Control  
Integrated Pest Management  
Air Quality  
Water Quality  
Soil Quality  
NGA 1: Sustainable Agriculture  
Agricultural Profitability  
Biotechnology  
Adding Value to New and Old Agricultural Products

**Issue:** There is a need for the development of environmentally safe control agents, to replace highly toxic petroleum-based wood finishes and pesticides. The development of new products and new production methods that are environmentally benign will provide economic opportunities for the Vermont population while protecting the environment from agricultural, commercial, and home-based activities. Commercial availability of a whey-based wood finish can reduce reliance on petroleum-based products.

Currently, commercial wood finish products are predominantly chemical solvent-based. Although these products give desirable quality, their volatile organic compounds are detrimental to the environment and harmful to the health. Whey is a byproduct from cheese making. This project is trying to use whey proteins from cheese whey as the primary binder to develop natural and safe wood finish products. This project utilizes whey proteins from cheese making as a major raw material to formulate environmental friendly wood coating.

Cheesemaking, a growing agricultural industry in Vermont, has a waste by-product of whey that farmers need to remove. Researchers at UVM have undertaken work to determine the effect of lactose and nitrogen-containing by-products from whey on the production, virulence and stability of select entomopathogenic fungi, and the utility of whey-based matrices for sprayable and granular formulations of entomopathogenic fungi,

**Activity:** Thermally denatured whey protein isolate (WPI) solution was incorporated into a waterborne resin (acrylic or polyurethane) based environmentally safe wood finish coating mix at different protein levels. The physicochemical properties (pH, density, viscosity, drying time, hardness, and etc.) of the coating mix and/or the films were examined in comparison to selected commercial wood finish products. The new WPI-resin coating products exhibited excellent mechanical and water resistance properties while released a much smaller amount of volatile organic compounds (VOCs) than the commercial wood finish products. The results show that the newly formulated environmentally safe wood finish coating prototype products may be used as alternatives to high VOCs containing commercial products for coating furniture, toys, and other high-end wooden products. Meanwhile, researchers are also working on the procedure and an experimental setup to examine the effects of protein incorporation and type and level of biocides on the mold resistance properties of the coating products, from which the results can provide

useful information to tailor the wood finish coating formulations for various coating applications with desirable mold resistance.

**Impact:** Researchers have demonstrated that cheese whey proteins can be used as a binding material in the development of new water-based environmentally safe wood finish coating products. Successful development and application of such a product will be beneficial not only to the wood and dairy industries, but also the environment and consumers. Researchers have made significant progress in beta testing whey-based wood finishes. Researchers have patented research findings. VT-AES researchers are now engaged in scale-up production and efficacy studies for a whey-based wood finish.

**Sources of Federal Funds:** Hatch

**Scope of Impact:** State Specific

## Goal 4

**Key Theme:** Water Quality  
Recycling

**Issue:** While as much as 40 percent of the phosphorus (P) load into Lake Champlain originates from surface runoff, the management technologies and practices for P removal from surface runoff are very few. Moreover, most of the currently available practices can not function if total suspended solids (TSS) are above 30 mg/L.

**Activity:** UVM researchers have invented a uniquely designed and simple system consisting of one or more filter units placed at the pollution source that removes phosphorus by specific absorption on metal hydroxides, Calcium- Phosphorus precipitation via electric arc furnace (EAF) with iron slag material, and bacterial uptake at specific hydraulic retention times. Efficiency of the system is very high with the capability to remove 40-90 percent of phosphorus and 40-80 percent of suspended solids from agricultural effluents containing various phosphorus concentrations from as low as 0.1 up to 100 mg/L. Cost of installation is minimal, little land is needed and no energy is required.

**Impact:** Research has shown this system works! The system can function efficiently (reducing P at about 75-90 percent) at total suspended solids concentrations as high as 100 mg/L, is easily installed, can flexibly reduce efficiently from various flow rates, has minimum land needs, can handle a large diversity of phosphorus concentrations, and is easily combined with existing drainage and treatment systems. In addition, the system provides a long term solution for phosphorus removal via regeneration of the EAF iron slag, and used slag has the potential to be re-used as a fertilizer or a soil amendment in acid contaminated waste sites.

**Sources of Federal Funds:** Hatch

**Scope of Impact:** State-specific

## Goal 4

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

**Issue:** *Bacillus thuringiensis* (Bt) is a naturally occurring bacterium that have insecticidal activity against certain insect pests. Bt corn represents a corn hybrid that contains *Bacillus thuringiensis* derived genes to promote expression of insect resistance. In 2003, Monsanto and EPA registered a coleopteran-active Bt for field testing as Yield Gard Rootworm against species like *Diabrotica virgifera virgifera*. While transgenic crops are being developed and planted region wide, studies are needed to assess potential impacts of these crops on beneficial soil organisms.

**Activities:** A no-till field experiment was conducted at the University of Maryland Research and Education Center (Beltsville, MD) using three field corn hybrids: transgenic hybrid transformed by Monsanto as event MON 863 isogenic non-transgenic hybrid treated with soil insecticides for rootworm control; and isogenic hybrid without insecticides as a control reference. Each treatment was planted after a rotation in soybean in a field that did not contain transgenic crops previously. Each treatment was replicated three times to give a total of nine experimental units. Soil samples were collected three times per year (pre-plant, mid-season, post-harvest) from each experimental unit in 2003 and 2004 to assess possible non-target effects of the gene proteins and soil insecticide in the rhizosphere of first generation corn. Nontarget soil fauna including nematodes, collembolans and mites were extracted from soil and analyzed for changes in community composition as indicators of soil ecosystem function.

Diversity of nematode communities were greater at trophic and genus levels in Bt hybrid than isogenic hybrids with or without insecticide treatment. Generally, in 2003, effects at a trophic or family level of resolution were minimal. When differences were apparent, values of trophic and genus diversity were greater in soils with Bt than non-Bt hybrids. Values of commonly used nematode community indices (e.g., maturity index, channel index, enrichment index, structural index, or relative abundance of trophic groups) were similar for Bt and non-Bt isoline hybrids. When nematode communities were analyzed at the genus level, major differences occurred between Bt and isogenic hybrids with or without insecticide. The observed difference is confounded with variation in soil properties of field plots at the beginning of the experiment. These differences diminish as the experiment continues through the growing season in 2003. Relatively abundant collembolan and mite taxa tend to be common between Bt and isogenic (without insecticide) hybrids, but less abundant taxa appear more treatment-specific. We have yet to determine whether changes in faunal community composition are short- or long-term and whether there are linkages between above- and below-ground communities. Peer-reviewed publications will be forthcoming.

**Impact:** The study is the first to: 1) comprehensively evaluate the effects of transgenic rootworm technology and the impacts of root exudates and release of endotoxin from decomposing Bt plant biomass after corn harvest on non-target soil and litter-dwelling invertebrates, and 2) examine

transgenic crop impacts in a no-till and repeated crop rotation scheme using standard agronomic practices. The study is significant because the researchers:

- focus on the potential of non-target effects of introduced foreign protein products expressed by *B. thuringiensis* genes on beneficial soil and litter fauna;
- provide information to help regulators assess and evaluate transgenic plant technologies by providing environmental and ecological impact data from realistic field studies conducted over multiple seasons to identify any longer-term impacts;
- test relatively longer-term impacts of transgenic crop in a no-till crop rotation scheme;
- include only data collected independent of industry sponsorship to assure objectivity in the results;
- establish appropriate methodology that will be readily adaptable for the identification and characterization of hazards to litter and soil fauna associated with future introductions of transgenic crops; and
- incorporate approaches that permit new agricultural biotechnologies to be evaluated by means of a science-based, collaborative process that is trusted by stakeholders and the public.

**Sources of Federal Funds:** Hatch

**Scope of Impact:** State Specific

## Goal 4

**Key Theme:** Natural Resources Management

**Issue:** Despite the increasing biological and economical impacts of invasive species, little is known about the evolutionary mechanisms that favor geographic range expansion and evolution of invasiveness in introduced species. Also, given the observed increase in invasions of non-native species, and the likely increase of future invasions due to global warming, environmental managers need predictive tools to lessen and eventually reverse the deleterious biological effects of invasive species on Vermont ecosystems. Predicting, understanding, and mitigating the effects of these invasions on the processes of these complex ecosystems depend on good predictive models of these systems. Therefore, there is the need to develop better mathematical models of invasive species dynamics and the biological systems they are affecting. Fortunately, predictive mathematical models of these systems can be invaluable tools to accomplish this difficult task. Models aid our attempts to predict future changes, and models can help us to understand better the inner workings of these systems and make our management decisions better informed and more effective. Two fundamentally different ways to conduct the modeling process are with deductive and inductive reasoning. In practice, scientists use a mix of both approaches to model ecological systems. The rapidly growing field of ecoinformatics is providing us with new tools for managing and analyzing increasing amounts of spatially and temporally diverse ecological data, thus aiding our efforts for data-driven inductive modeling. At the same time, the use of model-selection methods based on information theory is becoming increasingly popular among ecologists. Choosing a good model is very important, and a critical question then is: Given a set of models to select from, how does one decide on the best model for a given problem? Statisticians have developed numerous ways to guide the choice of an appropriate model, but they are all dependent on a priori specified models, whereas an evolutionary computation approach to model selection has the potential to incorporate novel models into the selection process. Evolutionary computation when combined with information-theoretic model selection, can serve as a bridge linking deductive knowledge-driven modeling to inductive data-driven modeling. UVM researchers are investigating one way to integrate these two modeling approaches: with an evolutionary computation method called Genetic Programming that evolves and tunes new predictive models given inputs of expert knowledge and real data.

**Activities:** FY2006 research focused on the invasive wetland grass *Phalaris arundinacea* to document the evolutionary consequences that resulted from multiple and uncontrolled introductions into North America of genetic material native to different European regions. Continental scale genetic variation occurring in *P. arundinacea*'s European range has been reshuffled and recombined within North American introduced populations, giving rise to a number of novel genotypes. This alleviated the consequence of genetic bottlenecks throughout the introduced range. Moreover, reed canarygrass had higher genetic diversity and heritable phenotypic variation in its invasive range relative to its native range. The resulting high evolutionary potential of invasive populations allowed for rapid selection of genotypes with higher vegetative colonization ability and phenotypic plasticity. While an increasing number of studies recognize that invasive plant species result from colonization events, our results show that such multiply-introduced species may become harmful invaders with high adaptive

potential. Such invasive species may even be very successful in adapting to predicted climate change, with increasing impact on native communities and ecosystems in future decades.

In FY2006, effort was also spent on optimizing our computer code for greater speed, implementing a new adaptive, diversity-preserving selection mechanism, setting up multi-tree genetic programming, and testing a series of one and two-stock models, including the classic Lotka-Volterra two-species competition model. The overall significance of these efforts is: the ecological computer program can now run to completion in a reasonable amount of time; the greater diversity of solutions available during the evolution of different models increases the success of evolving useful models; and the more complex one and two-stock models demonstrate the potential of this approach to address real-world environmental problems. In the remaining year of this project, researchers will move from testing the one and two-stock models to attempting to evolve models of real-world data from Lake Champlain, and the Proctor Maple Research Center.

**Impact:** This study provides a mechanistic understanding of how multiple introductions from disparate geographic locations of an agronomic species such as reed canary grass can result in the creation of individuals in the introduced range that are more aggressive than the originally introduced strains. It provides implications that can assist natural resource managers deal with invasive species through more aggressive strategies, recognizing the high levels of aggressiveness and potential harm caused by invaders. Additional information provides managers and decision-makers with information about invasive species that can be used in anticipation of continuing global warming trends.

This project will benefit environmental managers who need an enhanced ability to predict invasive species dynamics for directing their control efforts. Specifically, this project will make available a way to evaluate different invasive-species models, in terms of which biological and habitat factors to incorporate in the models to insure the greatest accuracy of model predictions.

**Sources of Federal Funds:** Hatch

**Scope of Impact:** State Specific

## Goal 4

**Key Theme:** Water Quality  
Soil Quality  
Hazardous Materials  
Natural Resource Management  
Sustainable Agriculture  
Integrated Pest Management

NGA1: Agricultural Competitiveness  
Agricultural Profitability  
Bio-based Products  
Managing Change in Agriculture

**Issue:** Whey-based fungal microfactory technology targets improvement in field deployment of fungi for biological pest management of insects, weeds, plant diseases and other pests. This technology relies on the nutritive value of sweet whey, which allows fungi to grow in tiny droplets after their application into environment, such as when sprayed onto leaves in agricultural fields or forests. Current fungal microfactory research is directed at the hemlock woolly adelgid (HWA), an invasive insect of forests, with recent press releases having generated considerable interest. Infested trees have been found in New Hampshire, Maine and Massachusetts, not far from Vermont. Although no adelgids have been found on native trees in Vermont, researchers believe the insect has crossed the state line, and the state has banned the importation of hemlocks -- nursery stock, boughs, and hemlock bark mulch -- from infested areas of the U.S. and Canada. Shipments of hemlock must be inspected for pests, before and after shipping. To fight HWA, beetles have been released, and trees sprayed with oils and injected with chemical pesticides.

Pesticide failures and environmental concerns generate considerable incentive to commercialize the many fungi identified to target members of most pest classes, e.g., insecticide resistant whitefly in cotton, methyl bromide replacement, mycotoxins reduction in stored grains, plant re-growth along power lines and combating invasive pests. For fungi targeting insects, the past four decades have seen 80 companies worldwide manufacture or develop 168 fungal myco-insecticides. Yearly, US-EPA grants registration to fungi for pest management, and the scientific literature is replete with publications on numerous mycopathogens for biological pest management. Most fungi used for biological pest management are relatively simple to mass-produce but production processes are space intensive and may involve costly growth substrates. This can make their final cost comparatively more expensive than chemical pesticides, and often limits fungal commercialization to only smaller, high value markets.

**Activity:** The fungus and sweet whey, a cheese-making byproduct, is sprayed on trees to kill the hemlock woolly adelgid, an exotic pest that is wiping out native trees from Tennessee to Massachusetts. As the fungus reproduces in the whey, UVM researchers have evidence that the spores will spread throughout the trees, piercing the skin of the insects. The tiny fungal factories

spontaneously activate under suitable environmental conditions and produce dramatic increases, as much as 100-fold, in the number of fungal spores for pest management. The additional fungus increases the dose available for infecting the pest. When fully developed, whey-based fungal microfactory technology will enhance the effectiveness and commercial potential of the many beneficial fungi under development for pest management worldwide.

**Impact:** The technology, with a provisional patent, has worked in the lab and on trees in Massachusetts. Whey-based fungal microfactories rely on sweet whey, an inexpensive by-product from cheese manufacturing. For fungi to be effective, the 'infectious units' must come into direct contact with the target pest. Fungal microfactories should allow greater opportunity for fungus/pest contact because of the high level of fungi produced and thus overcome physical and economic constraints of current strategies based on directly applying large amounts of fungi. In addition, some pests live in places that are difficult to reach and the additional fungi from microfactories would further enhance pest contact. The intention is to shift a significant portion of fungal production to post-application, out of 'brick and mortar' facilities and into nature. The tailoring of this technology to different fungi should dramatically improve the cost effectiveness of fungal biological control agents and enhance their contribution to environmental quality by reducing pesticide usage. Whey-based microfactory technology has the potential to facilitate widespread expansion in the adoption fungi for biological pest management.

<http://www.uvm.edu/~uvmpr/theview/>

"HWA is a pretty noxious insect. Certainly, any kind of controls that we can come up with that are ecologically safe and effective is well worth it," said Talbot Trotter, a research ecologist with U.S. Department of Agriculture Forest Service in Hamden, Conn.

**Sources of Federal Funds:** Hatch

**Scope of Impact:** Multistate Research (MA, VT)

## Goal 4

**Key Theme:** Integrated Pest Management

**Issue:** Crop production is an important part of the New England economy, both directly and indirectly as the foundation for maintaining rural landscapes that define New England's quality of life. But on the national scale, New England is a minor production region for most commodities. As a result, the needs of New England producers can be overlooked in national regulatory decisions. By conducting statistically valid surveys, creating crop profiles, and organizing pest management strategic plan meetings and documents, NEPMNet represents the needs of New England farmers to federal regulators. These documents are also useful to direct, measure, and justify pest management research and Extension programs.

In cooperation with colleagues throughout New England, UVM research and UVM 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.

**Activity:** The New England Pest Management Network (NEPMNet) is a coordinated effort among the Land Grant universities of the six New England states to promote the use of IPM and to improve communication about pest management topics important in New England. This year marks a decade of holding greenhouse IPM workshops in Maine, New Hampshire and Vermont, affectionately termed the "Traveling Road Show". A ten year evaluation shows that more than 1600 workshop contacts find greenhouse IPM workshops are directly responsible for reducing grower reliance on chemical pesticides and increasing their use of biological control and biorational compounds. The evaluations clearly show UVM is having an impact on grower practices that is improving the environment and human health. This success would not be possible without the tri-state collaboration involving growers, state Departments of Agriculture and the Extension systems. From its inception, this educational experiment demanded significant effort and long-term commitment by collaborators. For many years growers attended, but made it clear that IPM and biological controls, though interesting, were not for them. After a decade of work, most growers attending workshops now apply IPM practices and are using biological controls as well, as they have learned their value and gained confidence in their skills through workshops and other outreach. The results of these workshops show that it takes time to change grower practices. Growers need to hear an idea several times, and experience first-hand demonstrations and hands-on opportunities before they adopt new practices.

**Impact:** Ten-year evaluation result details show that:

- 94 percent of the growers learned new IPM techniques they would use this year;
- 60 percent of Vermont growers now use one or more biological controls in place of chemical controls;
- 10 percent more growers this year indicated they use banker plants compared with last year, which suggests that last year's workshop had a significant impact on grower behavior in this area;
- 87 percent of the growers indicated they made new contacts and appreciated this opportunity to meet with other growers;

- in all states attendance has increased, and in Vermont IPM educators have exceeded our limit of 160 participants several years running.

Other gleanings from the survey include that:

- many growers prefer hands-on and learn-by-doing formats over all other presentation styles; and
- IPM educators have reached success with participants such that there is now a significant gap between new learners and advanced growers, making it timely to offer a workshop for “novices”, with basic pest and disease ID and IPM principles;

Current tri-state IPM work includes:

- testing novel whey-based, sugar, and bakers’ yeast formulations to enhance the effectiveness of these beneficial microbes for use against thrips;
- comparing the effectiveness of predatory mites, a biological control agent sent long distances under adverse climatic conditions, to one- versus two-day shipping methods;
- testing different scouting and early pest-detection methods, assessing them in terms of the time they take and how effective they are at detecting pests; and
- designing cost-effective, environmentally-friendly greenhouses by integrating many technologies to capture heat from renewable resources such as manure, solar and geothermal sources, and to conserve generated heat with specialized insulating materials and reflective surfaces – changes that will enable growers and farmers to supplement operations with renewable energy, possibly reducing energy costs when utilizing nearby manure and producing compost, and that offer opportunities for dairy farmers to diversify their revenue sources.

**Success Story:** Many positive statements were received from survey respondents. Among them were the following:

“I am a veteran of these workshops, they have led me down the IPM road I now follow.”

“We are using less chemicals each year.”

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

**Scope of Impact:** Multistate Integrated Research and Extension (ME, NH, VT)

## Goal 4

**Key Theme:** Integrated Pest Management

**Issue:** Early pest detection is the cornerstone of IPM, enabling growers to address populations when they are low and localized. Indicator plants are varieties that are particularly attractive to pests. Growers often know which plants are more likely to become infested, and UVM specialists are using this information to develop more effective monitoring methods. Western flower thrips (WFT) is a major pest of greenhouse ornamental crops and few pesticides are available. When growers are able to detect WFT early, before they reach damaging levels, they have greater potential to use biological controls successfully and can produce higher quality plants. Knowledge of WFT daily activity patterns enables growers to apply pesticides more efficiently, reducing the need for multiple routine applications.

**Activities:** Research was conducted on utilizing indicator plants to optimize timing of early detection and treatments to contain thrips populations with a minimum of intervention:

- non-flowering crop of New Guinea impatiens, western flower thrips were detected 3 weeks earlier in an early spring on flowering marigold indicator plants than on yellow sticky cards;
- indicator plants with a very low thrips population can be kept in a greenhouse for at least 4 weeks before becoming a source of an outbreak; and
- thrips larvae were more active in the evening, making this an ideal time to spray a pesticide.

Research results were shared with more than 100 greenhouse growers in five workshops.

**Impact:** Growers reported that they used information from the indicator plants to treat a thrips outbreak early in the season during FY2006, and they stated that doing so reduced the problem for them all the rest of the season. Growers were able to maintain profitable crops, apply less insecticide, save money, and reduce negative impacts they might have on the environment by adopting the strategy of using indicator plants to detect and treat early pest outbreaks on their greenhouse plants.

**Sources of Federal Funds:** Hatch

**Scope of Impact:** Multistate Research (ME, NH, VT)

## Goal 4

**Key Theme:** Integrated Pest Management

**Activity:** Integrated pest management is essential for the wellbeing of our environment, yet most consumers have little or no understanding of what it is and why it is important. A public awareness program to promote IPM to customers who visit commercial greenhouses and garden centers was initiated at the Entomology Research Laboratory.

In cooperation with colleagues throughout New England, UVM research and UVM 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. IPM Specialists also need to know how much information reaches consumers making choices about pesticides in their foods. A consumer survey was conducted in Vermont to determine baseline information on the public's knowledge of IPM and its benefits.

**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 percent 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 Extension outreach specialists conducted surveys of IPM research and outreach impact on growers and consumers.

**Success Story:** A quote from the Pesticide Certification & Training Coordinator for Vermont's Agency of Agriculture:

“The yearly tri-state greenhouse IPM program is one of the best educational opportunities in the state for professionals seeking relevant and worthwhile information regarding pest management in greenhouses. I am so glad to see such a quality program that promotes IPM, for in my position I also see my fair share of presentations that push the chemical solutions to pest problems as the ‘go to’ solution instead of a ‘last resort.’ I am glad to award pesticide recertification credits to encourage Vermont's certified applicators to attend, and I always learn something new myself.”

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

**Scope of Impact:** State Specific

## National Goal Area 5

**Overview:** During FY 2006 UVM Extension and VT-AES efforts and resources were further integrated to improve the quality of Vermont's natural environment. UVM Extension and VT-AES contributed 19.5 FTEs, or 30 percent of total effort, toward National Goal Area 5, budgeting \$3,051,383 in federal and state funds toward projects in this area. During FY2006, VT-AES and UVM Extension initiated or continued twenty-two research projects, and UVM Extension made an estimated 21,296 direct contacts and 174,800 indirect contacts. Forty one and four tenths percent of direct contacts were youths and 3.7 percent represented ethnic minorities. The ethnic minority with the highest number of contacts was Hispanic, with 1.9 percent of contacts self-reporting in this group. To accomplish most work in NGA 5, UVM targets underserved groups, such as low-income individuals and families and rural agricultural workers, as well as vulnerable groups, such as at-risk youth and children. UVM Extension worked with 3,270 volunteers (1,056 for 4-H alone), who contributed 23,991 hours of their time toward NGA 5 programs.

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 \$13.5 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 thousands of youths and adults to use computers and internet features to improve their lives. 4-H youth development programs, with 6,692 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.

Additionally, UVM Extension and VT-AES work together to:

- develop business district analysis to support economic expansion in Vermont's downtowns;
- teach life skills to youth through traditional 4-H, afterschool 4-H, and horticultural training, enabling them to become contributing citizens and potential future leaders;
- provide education, training and networking to support tourism and recreation as a positive contributor to economic and community development;
- evaluate the impact of access to capital for development of entrepreneurship opportunities in Vermont;
- provide education for tax practitioners on latest federal/state income tax law;
- provide educational assistance to youth from migrant farm families in Vermont communities;
- inform policy makers about the demographic trends of young adults in Vermont;

- develop the capacity of locally elected and appointed officials to improve the effectiveness and efficiency of local government;
- provide technical assistance on access to information technology to assist local governments in responsible decision-making regarding community planning; and
- create and support resources to empower local entrepreneurs in rural communities.

**Goal 5**

**Allocated Resources**

Research:

Hatch Funds:	\$ 218,806
All Funds:	\$ 638,645
FTE's:	5.3

Extension

Smith-Lever Funds:	\$ 633,520
All Funds:	\$2,412,738
FTE's:	14.2

## Goal 5

**Key Theme:** Community Development

**Issue:** Small densely populated communities surrounded by working agricultural landscapes and diverse forestlands characterize the scenic quality of Vermont's environment. In addition to providing quality habitat for Vermont's wildlife, much of these woodlands support recreation, tourism, and wood products industries that contribute significantly to the state's economy. The northeast regional economy typically rises and falls with changing demand for durable goods, making it susceptible to recession. Recent losses of a major wood manufacturing business and extreme uncertainty in the paper industry make it apparent that the regions economy is precarious.

**Activity:** The Northeast Kingdom (NEK) Travel and Tourism Association (NEKTTA)'s participation in the Geotourism project has been partially responsible for the substantial growth of the not-for-profit organization's network, development of contacts, and business relationships.

**Impact:** In FY 2006, seven of the ten chambers in the Northeast Kingdom joined NEKTTA (two already were members) and NEKTTA's marketing partnership program grew from 5 to 143 individual businesses working together to create and expand natural resource-based enterprises. NEKTTA's focus on Geotourism promotes awareness of the importance of forest, wildlife and water resources to the tourism industry, contributing to the sustainable growth of revenues and jobs in Vermont's Northeast Kingdom.

**Activity:** A Business Coach program, focused on small business opportunities in the renewable forest-based resource area will bring new development tools to a region that has defied most conventional rural development approaches.

**Impact:** During the past 18 months, 67 clients have been served through the program in 31 communities in three counties through the Jobs Coach program. Results of a survey show that 80 percent of businesses assisted are women-owned businesses and meet low to medium income criteria, and 65.5 full time employment positions are affected. An additional 25 employees (38 percent increase) are expected to be employed in these businesses by FY2007.

**Success Stories:** Quotes from community groups and clients include:

- “We believe that the NEK Business Coach project fills an important gap in the business technical assistance services available in the NEK through helping people with the preparatory writing and product idea development work as well as overall confidence building. Such assistance can ease the workload and prepare clients to work with Micro Business Development Programs and the Vermont Small Business Development Center.”
- “Our organization works in the NEK to develop the infrastructure and readiness of businesses to attract increased numbers of tourists as well as anticipate the needs of tourists already in the NEK. The NEK Business Coach program is a natural complement and partner to our efforts ....”
- “The Business Coach identifies individual training needs and makes referrals to the appropriate technical support programs. The position also supports networking between

entrepreneurs with similar areas of interest creating a peer support network that is especially important for people new in business.”

- “... [the Business Coach program] has been very helpful as part of the team implementing the VWBC’s Rural Business Enterprise Grant project ‘The Art of Success: Business training and portfolio creation program.’ This project is helping artists in the Northeast Kingdom create jobs for themselves and others through classes, one-on-one technical assistance, and monthly peer group meetings.”

**Activity:** Working with rural Northeast Kingdom (NEK) communities using a strategic planning and action process, Take Charge/ ReCharge, helps communities find alternative ways to meet community development needs. As part of these efforts, UVM Extension implemented a What Works! Conference held Sept. 28-30th in Burlington. UVM Extension conducted an Island Pond business survey research including interviewing summer visitors; and

**Success Stories:** One Take Charge activity was conducted with the a town’s Community Forum to conduct area market surveys with three audiences (residents, winter visitors, and summer visitors) in order to help identify businesses or services which could profitably locate in the Town of Brighton. The survey also asked for opinions and attitudes regarding a variety of activities the participants undertook in the Brighton area.

The following were selected by the majority as the top three businesses needed and rated them to be “very important” or “important” to add:

- drug Store (73 percent, and top choice for each group);
- laundromat (66 percent); and
- clothing Store (64 percent), with
- restaurant being first and second choices of winter and summer respondents.

The respondents reported what they liked best about the community were Aesthetics/Location (151), Friendly People (58) and Snowmobiling (31), with Aesthetics/Location being the top choice for summer visitor and resident respondents and Snowmobiling the top choice for winter visitor respondents. The respondents reported what they liked least about the community were Law enforcement (70), Lack of Shopping/Services (38) and Tourism by out-of-Staters (20), with Law Enforcement the top selection among winter and summer visitors responding, and Lack of Shopping/Services topping the list for resident respondents.

The report recommended that the community forum, using the information from this report, further investigate the possibility of promoting new businesses and expansion of existing businesses to incorporate the findings of the study. The report also suggested that Aesthetics/Location is a contributing factor in why people live and visit the community, and maintaining the aesthetics is important to drawing visitors and residents to the area.

As a result of Take Charge/ ReCharge efforts, UVM Extension and communities have seen the following occur:

- two new art galleries have opened in rural towns;
- a community forum received a USDA Rural Development Grant of \$80,000 to complete their funding package for construction of their Welcome Center;
- UVM Extension is now planning a "Big Box" forum to be held in 2007.

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

**Scope of Impact:** State Specific

## Goal 5

**Key Theme:** Community Development  
NGA 1: Bio-Fuels

**Issue:** Gas prices have increased, as has concern about harmful emissions from vehicles. Visitors to Vermont are looking for environmentally conscious ways to travel. Biodiesel presents an immediate opportunity for the motorcoach industry; other alternative fuels present future opportunities.

**Activity:** UVM Extension has teamed up with the Vermont Tourism Data Center to initiate the Green Motorcoach Certification Program. During the next 5 years this venture will create a nationwide network of certified biodiesel users. Partners initiated a pilot program with Lamoille Valley Transit based in Morrisville. The inaugural ride was at the Vermont Travel Industry Conference, and Lamoille Valley Transit is now running biodiesel in all of their motorcoaches. The partnership continues to provide technical assistance and marketing support including an Across the Fence Taping and press releases.

**Impact:** Lamoille Valley Transit (LVT) reports that sales are up 14 percent from last year as a direct result of increased businesses due to biodiesel use. This translates into 157 bus days or \$120,000. LVT won a competitive contract with St. Michael's College largely because of their biodiesel use. They expect to bring in an additional \$100,000 per year from that contract.

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

**Scope of Impact:** State Specific

## Goal 5

**Key Theme:** Community Development

**Issue:** Tax preparers need to have the most up-to-date information to assist Vermont taxpayers with an increasingly complicated taxing system.

**Activity:** A 2-day UVM Extension Tax School was conducted in two locations with 288 paid registrants, and 21 volunteers providing 680 hours during the year to plan, teach, and evaluate the school. Volunteers included attorneys, certified public accountants, and enrolled agents, along with Internal Revenue Service and VT Department of Taxes employees.

**Impact:** Course evaluations showed that 288 participants had signed 85,000 returns, roughly a third of all returns filed in the state. Of respondents,

- 95 percent agreed or strongly agreed that the School would help to improve the accuracy of the returns that they file.; and
- 95 percent either strongly agreed or agreed that the Tax School has given them the most current tax information before the tax season begins.

Comments from the evaluation included:

- “I would be out of business without the School.”
- “[I am] able to give accurate and better service to my clients.”
- “[The] mystery has been removed from VT forms.”
- “Excellent presentation of practical steps to implement theory- good how-to stuff.”
- “Creative planning tools.”

UVM Extension specialists have been asked to review IRS public documents over the past five years, with an average of 75 percent of recommendations made being adopted.

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

**Scope of Impact:** State Specific

## NGA 5

**Key Theme:** Community Development  
Youth Development

**Issue:** Some Vermont teenagers do not leave high school with the necessary skills to become productive members of the labor force. Additionally, young people in Vermont and across the country are increasingly disconnected from the source of their food. The “Summer Work and Learn” program reconnects young people to where their food comes from, empowers them by providing them with productive labor, and teaches them job skills that can be transferred to any profession.

The Youth Horticulture Project, Work and Learn, was developed through a collaboration between UVM Extension and the Vermont Department of Labor provides a hands-on job training program for teenagers. Participants develop life and job skills, learn to make healthy food choices, and contribute to healthy food production in their community through markets and donations. Thirteen teens participated in a seven week summer program for a total of 160 hours.

**Impact:** Evaluations reveal that twelve of thirteen participants made gains from pre-program to post-program, with particularly high increases made in developing marketable skills, including teamwork, following instructions, problem solving and responsibility. These gains are similar to previous years, and over the past five years the program has reached nearly 100 youth. When asked to name the most important thing they gained, participant responses included...

*“Meeting new people and overcoming nervousness and anxiety”*

*“Better communication and leadership skills”*

*“The knowledge of working on an organic farm”*

**Success Stories:** Past participants’ continued interest in the program has led to an expansion of the program to include mentorships and other opportunities:

- Two interns were recruited from Antioch graduate school to lead the two crews of teens on the educational gardens. We have noticed that alumni from previous programs return to the Summer Work and Learn Program. For this reason, educators created an opportunity for these alumni expand on and deepen the skills they have learned here to apply to become assistant leaders. They worked with their crew leaders and the other staff to gain leadership skills.
- The teens in the Work and Learn Program mentor elementary age children from three low-income housing sites in Brattleboro. They lead them in gardening and cooking activities for six weeks during the summer. Strong mentoring relationships are developed. In 2006, 13 teens in Summer Work and Learn program mentored 26 elementary age youth.
- Through a collaboration with the Tutorial Center and the Department of Labor, outreach specialists piloted the program in a new community where eight teens built a new garden at the community middle school, transforming weeds into a productive, educational garden that produced vegetables and plants they then sold at the weekly farmers’ market and to staff and students at the local college.

**Activity:** The Girls Grow program was a new program piloted this summer and funded by the Vermont Women’s Fund. The goals of the program are to: 1) Promote healthy lifestyles through nutrition, physical activity, and positive body image; 2) Provide a safe and supportive environment where young girls are empowered to learn new skills, develop healthy relationships, and gain self-confidence; 3) Develop the life skills, such as communication, team building, and problem solving, of young girls, which can be transferable to job skills in the future. Nine girls tended to their own small vegetable and flower garden, designed and planted a perennial and herb garden, prepared and shared a meal with produce from the garden and mentored early elementary aged children in gardening and nutrition activities.

**Impact:** Survey results show that eight of nine participants made significant gains from pre-program to post-program in life-skills categories of communication, marketable skills, healthy lifestyle choices as well as positive body image. When asked to respond to the statement “The most important thing I have gained from attending this program is...”, all responses included a comment about improved relationships with others; for example, “I learned how to get along with others better. And I’ve definitely improved my attitude towards specific groups and people.” Most comments also included a mention of how participants wanted the program to last longer each day over more months.

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

**Scope of Impact:** State Specific

## Goal 5

**Key Theme:** Community Development  
Youth Development

**Issue:** 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.

**Activity:** 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. Currently 35 percent of the eligible MEP student population is Hispanic, whereas Hispanic migrant workers represented just one percent of the eligible population in 2001. In 2001 there were no Hispanic children under the age of six, 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.

To increase awareness of the MEP and to increase public school involvement regarding referring students to the program the MEP sent a mass mailing of information to every public school principal in the state (328) and to every superintendent of schools in the state (60). Since this mailing in early September many principals and school secretaries have been calling to make sure they are using forms properly, and to follow up on the progress of their referrals.

**Impact:** The Vermont Migrant Education web site had more than 2000 hits during FY2006. This year The Migrant Education Program (MEP) project enrolled 300 students into the program. Of the nearly 200 families interviewed, 81 (COE's) students were submitted to the VT Department of Education, and only two (1.62 percent) were found to be ineligible, well below the target error rate of 15 percent or less.

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

**Scope of Impact:** State Specific

## Goal 5

**Key Theme:** Community Development  
Youth Development

**Issue:** Youth life-skills, citizenship and leadership development are key needs in a state losing its youth to other states upon adulthood. Geospatial education is rapidly becoming a needed skill for our youth in Vermont to obtain in order to become/remain competitive with youth in less rural areas. The Department of Labor released a report in 2005 stating that the top five positions to be sought after between now and 2012 will require geospatial skills. Below are selected programs highlighted for 4-H NGA 5.

**Activity:** For over 90 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](http://www.uvm.edu/extension) for more information.

**Impact:** Vermont 4H served six percent more (6,692) youths during FY 2006 than in FY2005, with the help of 1,056 volunteers, an increase of 15 percent. A much needed database cleanup continues, and has made reporting of membership numbers more accurate. More than two-thirds of participants live in towns with fewer than 10,000 people, and an additional twelve percent live on farms, reflecting the rural and small-town audiences primarily served. Youth reached through 4-H school enrichment opportunities continues to climb, with a 21 percent increase over last year, to a total of 2,700 youth participants.

**Success Stories:** A mother of a young teen noticed a marked change in her ability and willingness to speak to other individuals and in public settings since joining 4-H, and participating in action exhibits and stage presentations at the county, state and regional level.

Fourteen 4-H club members sold food at a town celebration and held pony rides with all profits going to the "Relay for Life" Cancer Walk; the club then participated in the Relay for Life Walk, raising over \$1500 to be used for cancer research.

One very quiet young man, who was diligent with record keeping, and who worked very hard through the years with his dairy projects only to end up in his showing classes near the bottom of rankings, finally reached his goal of being a member of the dairy quiz bowl team last year. He returned to take on a leadership role at this year's event by supervising a certain age group, speaking in public to them, and maintaining leadership and organization of the group. Since then, he has applied to participate in the National Dairy Conference held in Madison, WI.

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

**Scope of Impact:** State Specific

**Activity:** Vermont 4H is serving a growing area of interest – technology, as participation increased from less than one to more than five percent of all 4H members in just two years. To meet this growing demand, Vermont 4H has sought and obtained funding to support several technology-based club activities and initiatives:

UVM Extension has created and tested tools, resources and a CD-based curriculum targeting all school-age levels called “Exploring Spaces, Going Places” to assist youth in developing necessary geospatial skills. The curriculum has since been released by the National 4-H group and is being supplemented with a web site to offer additional resources, activities and support materials. A national 4-H GIS/GPS listserv was created to open dialog in this area and the result has been overwhelming. UVM Extension 4-H has received numerous requests for materials from organizations throughout the US, as well as international organizations and military installations. Currently there are 8 ESRI grants utilizing parts of the curriculum in the state serving 121 youth in grades K through 8.

**Impact:** First-year results show that an average of seventy-five percent of students showed gains in developing useful and marketable skills, leadership skills, communication skills, using resources wisely, and decision-making skills.

**Success Story:** 4-H youth from Essex sponsored a GIS event held in Burlington and served as good will ambassadors for youth in community geospatial action. Using GIS to address childhood obesity – 4-H youth completed an ESRI (Environmental Science Research Institute) grant project by creating and placing on community websites, 10 maps identifying and locating recreation facilities for community members. Efforts are being made by 4-H educators to assist leaders in pursuing their own grants to make GIS/GPS a statewide youth-based program.

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

**Scope of Impact:** State Specific

**Activity:** The National Military Family Association (NMFA) chose University of Vermont 4H and Greater Burlington YMCA to host a popular Operation Purple Summer Camp in 2006. The camp provides free opportunities for children aged 9-14 of military families whose parents are, or were recently, deployed, to enjoy 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.

**Impact:** Ultimately, 80 percent of 58 participants indicated they made gains in life skill development as a result of Operation Purple Camp. The following life skills were evaluated: communication, accepting differences, useful/marketable skills, healthy lifestyle choices, and self-responsibility. The two indicators that respondents made the most gains in were “the ability to work out problems that are presented to me”, and “the ability to clearly state my thoughts, feelings, and ideas to others.” Open ended questions revealed overwhelmingly that this experience enabled campers to feel more comfortable making new friends and meeting new people, and how important teamwork was for getting things done and helping make it through

hard times. The collaborative effort between UVM Extension 4-H, YMCA - Camp Abnaki, and the National Guard was viewed as successful by the granting agency, and grant funds have been obtained to conduct the program next year for more than 100 youth in military families.

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

**Scope of Impact:** State Specific

**Activity:** Several measures were taken to assist clubs in carrying out the mission of helping as many youth as possible to develop themselves through a 4-H experience.

- Pooling resources of partnering organizations to consolidate and provide better services to youth at statewide events (such as the Dairy and Junior Holstein shows); and
- Working with teachers to improve 4-H curricula to match with state education standards (such as with the Growing Connections measurement program and the GIS program).

**Success Stories:** In one county these efforts have led to reinvigorating a 4-H program that had nearly reached local extinction. Less than three years after a county's 4-H presence was near extinction, the county has doubled the number of clubs and more than tripled enrollment, with an additional two clubs starting up, and the county hosted their first horse show in a decade. Most people thought 4-H no longer existed in the county; now UVM Extension's 4-H is invited to community discussions on youth development, and has several afterschool site programs, in-school enrichment programs, and two school sites were awarded 4-H/ESRI GIS grants.

Leadership development of 4-H staff members has enabled 4-H staff to better facilitate conversations between groups involved in ventures showing low success to bring about solutions that will increase success, morale and participation for 4-H members – in one case an uncooperative group of leaders was assisted, with youth involvement as well, to work well together, work well with 4-H educator staff, and expand their involvement in 4-H to include record keeping and participating in local fairs.

Leaders have mentioned the following successes:

- In areas where membership is in decline, 4-H foundation trustees have stepped up to the plate and directly sponsored 4-H promotion events and activities;
- By updating the 4-H website and providing special workshops to address volunteer leader concerns about navigating the website – in this case the UVM Extension mobile computer lab assisted in bringing this workshop to local areas – leader perceptions and use of the website have greatly improved;
- By improving record-keeping systems that reduce time required for leaders, they have more time to assist youth directly due to the improved record-keeping process;
- By teaching club members proper ways to conduct business meetings using parliamentary procedures has resulted in youth taking a stronger leadership at meetings:
  - two teen 4-H members have been nominated and elected to three county 4-H Foundations with full voting rights, and the by-laws are being amended to include a third youth on the board;

- a Teen Committee was formed with all senior Dairy 4-H members that effectively planned, organized & hosted the State 4-H Dairy show in Caledonia County. This Teen Committee also participated in a Dairy Showmanship Clinic, working one-on-one with junior 4-H members from Caledonia & Orleans Counties;

Some quotes from "4-H Stories" regarding the impact record-keeping has had on youth:

- "I think 4-H has improved my life and school career because of components like writing and reflecting in record books as well as keeping records, planning, and organizing.";
- "This has made such a positive impact on [my daughter's] life and I want you to feel good about how this has influenced a child's life";
- "This is great for ... teens to make new friends, think outside of themselves and become more responsible and caring. This is great for my kid!"

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

**Scope of Impact:** State Specific

## Goal 5

### **Key Theme: Youth Development Community Development**

**Issue:** From The CYFAR webpage: “The National Children, Youth, and Families at Risk (CYFAR) Program ... provides funding to 45 land-grant university extension services for State Strengthening and New Communities Projects, serving 60,000 youth ages pre-K to 19 and their parents. ... These state CYFAR projects call for collaboration across disciplines, program areas, and geographic lines, as well as a holistic approach that views the individual in the context of the family and community. ... To assure that critical needs of children and families are met, CYFAR supports comprehensive, intensive, community-based programs developed with active citizen participation in all phases. CYFAR promotes building resiliency and protective factors in youth, families, and communities. CYFAR supports collaboration--forming lasting partnerships to achieve greater outcomes and to provide a support base for sustaining programs for those at risk. CYFAR also promotes the use of technology to improve programs, provide efficient access to educational resources, and provide essential technological skills for youth and adults in at-risk environments.”

**Activity:** During FY2006, in-kind (\$170,543) and cash match (\$139,612) provided for \$310,155 to fund 43 new programs and expand and 31 existing programs, with 58 volunteers supporting programs delivered, and 59 community collaborators participating. Programs are driven by AmeriCorps volunteers who serve as educators and mentors to at-risk youth participants. A coordinator trains volunteers in evaluation (logic model), program implementation (Experiential Learning Model), use of curricula (4-HCCS, JASON, WonderWise, Project Wild) and other trainings (CPR first Aid, Mandatory Reporting of Abuse, Behavior Management, Bully Free Zone, Wilderness First Aid, Conflict Resolution, After school Provider Training, GPS training, True Colors Team Building/Personality Assessment, Ages and Stages of Youth development). Additionally, they receive computer training in PowerPoint, Journal Creation, and Electronic time management.

Collaboration development is a primary goal of CYFAR projects. As such, the characteristics of these relationships may vary somewhat but they all provide an opportunity to reflect commitment to support youth programming. Discussions with youth currently participating in programming serve as needs assessment resources to assist in determining program design for future development. Volunteer opinion polls also provide valuable input for programming and training needs. Partners provide in-kind support, space, materials, and other valuable resources assuring program success. Schools supported after school efforts and school enrichment programming. Working closely with after school program coordinators and volunteers resulted in successful program support and lifeskills development.

**Impact:** Nearly 1,000 youths (936) were reached with lifeskills development programming, and 72 percent of participants indicated they made at least one behavioral change related to lifeskills development as a result of participation.

- The EnviroQuest Afterschool program was implemented to provide rural youth with opportunities to increase lifeskills and develop practical science and technology skills. As a result, 317 youth ages 11 to 13, who participated in the program, self-reported an average of 79 percent advancement in decision making, wise use of resources, useful and marketable skills, leadership and communication lifeskills from pre to post program (Washington Lifeskills Evaluation System), and another seven grants have been awarded to sites.
- Implementation of nine global positioning systems (GPS) programs in a school enrichment environment were initiated resulting in 47 percent of participants who made gains from pre-program to post-program focusing on the life skills of useful and marketable skills and decision making.
- In two after-school programs focusing on Aerospace, 72 percent gained from pre-program to post-program in communication, and useful and marketable skills.
- In three after-school programs and a camp focusing on videography, participants demonstrated a 70 percent gain from pre-program to post-program focusing on the life skills of wise use of resources and leadership.
- In a Movie Life camp focusing on videography, 78 percent of participants made gains from pre-program to post-program in useful and marketable skills and communication skills.
- In Nature Adventures and Hiking Navigator, two programs focusing on environmental science and GPS skills development, 60 percent and 67 percent of participants, respectively, made gains in wise use of resources and communication skills.
- Pallets of Fun, focusing on arts and crafts and camp participation reflection, resulted in 50 percent of participants making gains in decision making and communication skills.

Collaboration development and strengths are evaluated utilizing ECO Maps. These graphic representations are updated to illustrate changes in strength and partnerships. Evaluation results reflect an increase from nine weak to 18 solid strength collaborations during the program period at the pilot site. The Johnson community demonstrated an increase from five to ten solid strength collaborations. Newport demonstrated an increase from four to six solid strength collaborations and Whitingham demonstrated an increase from 11 to 12 solid strength collaborations.

**Success Story:** Based on attendance, youth participation and results from evaluations, the EnviroQuest Afterschool pilot program will be expanded. Youth participants were invited to participate in the Northeast Regional Geospatial Information Center Steering Committee meeting, and their comments are being used to revise the focus of the project to meet the needs of youth. The Junior Counselor program has successfully supported retaining participants that are aging out of the program by involving them in the program delivery. This was successfully accomplished with two participants this program year. Both of these now high school aged youth, have asked that they be retained in this capacity as long as educators feel they have value. We have assured these that participation and leadership skills are needed for the younger participants of our program and welcome their support.

Geospatial community partners continue to appreciate the need for support of this technology. As such, a northeast region group is developing to work toward the development of a geospatial information center. This center will encourage project creation by sharing common project

information necessary for all community mapping efforts by youth in this northeast region, preventing the reinvention of the wheel.

**Funding Source:** CYFAR

**Scope:** State-Specific

## **B. Stakeholder Input Process**

At UVM, the “Research-Extension-Vermonters” 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. Board members, appointed by the President of UVM, represent leaders in agriculture, small business, sustainable agriculture, food and nutrition, biology and life sciences, rural community development, higher education, and public affairs. 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 Vermonters Opinion Poll. UVM Extension has supported 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.

UVM Extension meets with a State Advisory Board and receives advice from regional and program-oriented advisory committees. 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, and includes youth members. 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.

Additional stakeholder input for UVM Extension is explained by describing how it is obtained for program areas within each National Goal Area. Program-specific advisory board members are selected with the input of staff, faculty, and final decision by the Extension administration, and include clients, commodity groups, and other Extension, AES, or university colleagues. Each advisory group meets twice a year, receives informational mailings and telephone calls, and communicates through program-specific listservs. Members provide advice during UVM Extension’s annual formal planning period to help determine the best use of limited resources, the most effective way to deliver a program, and opportunities for creating partnerships and conducting cross-program interdisciplinary work, as well as helping to determine how best to integrate research and Extension activities to meet program needs.

Agricultural needs and interests for the state are served by an advisory group consisting of ten members representing dairy producers, non-livestock producers, bankers, and representatives of industries selected by Extension program leaders, who provide input relative to the structure and content of outreach efforts conducted throughout the state.

Food Safety and Health program personnel receive input from a five-member Food Safety and Health Advisory Group consisting of representatives from UVM faculty, VT Food Bank, Northeast Organic Farmers Association, Education and Training Council, VT Department of Health, VT Department of Education, VT Department of Agriculture, VT Department of Aging and Independent Living, VT Restaurant Assoc., VT Manufacturing Extension Center, AARP, VT Campaign to End Childhood Hunger, SERVE New England, VT Department of Employment and Training, Head Start, Community Action Agencies, Farmer's Market Association, VT Specialty Food Association, VT Association of Child Care Resources and Referral Agencies, mental health associations, VT Department of Children and Families, Area Health Education Centers, educators, childcare providers, food service managers and food producers.

UVM Extension Natural Resources Management program personnel consult with landowners in control of natural resources management, users of Vermont's natural resources, organizations interested in natural resource management, natural resource-oriented tourism and business groups, and individuals interested in natural resources management.

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 and youths who bring diverse experiences and perspectives to discussions and decision-making. 4-H Foundation boards now include youths as voting members in many counties. Youth provide leadership and program-development input at 4-H club meetings through meeting processes UVM Extension has established as a standard throughout the State.

Information on programming to meet the needs of these stakeholders also comes from surveys, personal discussions, memberships on boards and committees, and a wide range of representatives on Extension boards and councils. UVM Extension continues to use formal and informal processes that ensure advisory input can support organizational efforts to prioritize and focus program efforts on relevant problems facing Vermonters.

## C. Program Review Process

### Vermont Agricultural Research Station

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

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

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

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

### University of Vermont Extension

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

- Impact -- potential for producing a measurable, positive impact on Vermonters
- Resource availability/accessibility -- resources exist to implement programs
- Reaching audiences -- programs are likely to meet needs of underserved population
- Customer demand -- programs are linked to clearly articulated customer need
- Collaboration -- potential exists for collaboration between states and disciplines

- Innovation -- programs are unique or are not done well by others

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

Since FY2002, UVM Extension has implemented a program development process integrating Logic Model and Outcomes-Based evaluation concepts. The logic model framework is implicit and explicit in all evaluations performed using on-line software, leading to more complete evaluations, increased compliance and participation, and more consistent results. Staff and faculty work together to develop five-year and annual plans based on logic models they develop through an on-line interactive, institutionally open software program. Annual plans and quarterly outcome measures and impact statements are required by all personnel. The process used, involving annual system-wide, program-specific, and individual logic model development, has helped UVM Extension focus efforts toward a specific set of goals to best meet the needs of Vermonters, define expected outcomes, prepare evaluation plans, and to determine where effort needs to be most applied to leverage additional funds.

All staff and faculty have been reporting on-line since FY2002. Logic-model software has been updated through a multistate effort, creating a more flexible, open-ended, and user-friendly planning and reporting tool, called ALBERT. This is the first year data in the CSREES report included data from this new system. Feedback has been overwhelmingly positive from staff and faculty users. Additional evaluation software being widely used in by UVM Extension personnel include Perseus, supported by Extension personnel; the Washington Life Skills Evaluation System; and the Pennsylvania Life Skills Evaluation System.

#### **D. Evaluation of the Success of Multistate and Joint Activities**

As part of the national land grant system, UVM Extension and Agricultural Experiment Station are involved in a variety of multi-institutional 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 30 multistate and integrated programs conducted by UVM Extension and VT-AES.

UVM works with:

- federal agencies, such as the US Forest Service in reducing conflict over use of national forest lands;
- state agencies, such as the Department of Agriculture, and Department of Education to assist farmers, migrant worker families, and youth across the state to develop life and business skills;
- non-profit agencies, such as the Northeast Organic Farmers' Association and the Vermont Land Trust to bring economic opportunities to current and aspiring farmers;
- other states to develop nationally transferable curricula designed to assist middle school students make safe food handling decisions, and obese adults to lose weight and maintain weight loss over the long-term;
- towns and community organizations to bring about systemic change to food purchasing systems;
- other universities to conduct New-England based and cold-climate agricultural research, as well as to develop tools that can combine resources for improved efficiency and user-friendliness in planning and reporting using logic-model based evaluation systems;

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. Multistate Extension Activities**

During FY2006, UVM Extension conducted fifteen major multistate projects, and VT-AES conducted ten multistate research projects. UVM Extension applied \$805,447 in Smith-Lever funds to multistate projects, approximately a 31 percent increase over FY2005 (\$616,099). Projects spanned all five national goal areas, with highlights noted in the following section. UVM worked on national research projects, including the development of 43 new and 31 existing lifeskills and technology-based after-school programs targeting at-risk youth, with 58 volunteers supporting programs delivered, 59 community collaborators participating, and 936 youth reached with lifeskills development. Other national programs include creation and testing of a middle-school based online learning curriculum for food safety and health topics, and the development of a cold-hardy vineyard industry. Working with New England states, UVM has created new agricultural opportunities for farmers, including new loan programs for non-dairy livestock producers, and precision pest control using biological agents. Researchers also investigated the profitability for organic versus conventional small dairy farming, typical to the northeast.

## Assisting Small Farm Ventures

A) Land Link VT links farmers and non-farmers interested in selling and purchasing farmland offers support for new farmers and farm families making transitions to the next generation by offering workshops, partnering with other states and nations (e.g. England, Switzerland, Italy, and Spain), partnering with complementary organizations, such as Vermont's Small Business Development Center, offer business management courses, and conducting research to determine the needs for successfully linking current and interested farmers. The 14 workshops reaching 469 individuals over the past three years, along with approximately ninety farm visits during that time, have yielded more than twenty successful farm transfers, representing approximately 1800 acres of farmland. Nearly all (97 percent) of the 95 farmers who participated in the Tilling the Soil workshop stated that the course met their expectations and they planned to use the information to begin or expand an existing agricultural business, or revise business objectives.

B) UVM Extension and Maine partnered with Northeast Organic Farming Association to lead the first, and largest, multistate study to date, measuring the profitability of organic dairy farming operations. Organic milk production is the fastest growing agricultural sector in New England. The on-farm price of 'conventional' milk has had tremendous highs and lows in the past five years. A steadily growing demand for organic dairy products is creating a market with stable prices for dairy farmers who decide to ship organic milk. Organic milk appears to be a way to bring more cash into the farm without increasing the herd size. Organic dairy farms now account for 8.5 percent (105) and 18 percent (63) of dairy farms in Vermont and Maine, respectively. The retail market is growing at 20 percent per year. Researchers collected 2004 and 2005 data from 30 organic dairy farmers (13 VT farmers and 17 ME farmers) who averaged 48 cows, sold 14,060 lbs of milk per cow at \$22.97 per cwt while production cost was \$22.58 per cwt. Results of the study showed that:

- only one third of organic farms were profitable;
- after including economic costs for depreciation and the owner's labor, the average return on equity for organic farms was a disappointing -3.0 percent;
- when organic dairy farms were compared to conventional dairy farms with fewer than 90 cows as published in Farm Credit's Northeast Dairy Farm, the average conventional dairy farm needed to milk 17 more cows than their organic herd counterparts to earn \$137, and organic dairy farms earned more net revenue per cow and hundred-weight;
- profits for organic dairy farms declined 42 percent since 1999, which supports farmers' claims that profits were down and a higher organic milk price was needed;

The results of this study were used to justify a higher organic milk price that was delivered to farmers in late 2005. The results of this study benefited the numerous dairy farms in transition to organic, current organic dairy farms, and conventional dairy farms thinking of transitioning to organic. Results have since been published in every major dairy publication, presented at conferences, published in major and broadcast on the Paul Harvey show. The timely study provides important benchmarks for the cost of producing organic milk for farmers, Extension specialists, and lenders to use for comparisons and for budgeting. Study results have increased public awareness about the organic dairy farming business much more than was anticipated prior to the release of the research.

C) Working with eight other states, Vermont outreach and research experts have helped approximately twelve cold-climate vineyards to become established 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.

D) 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. More than 700 individuals have received technical assistance and 800 have attended workshops conducted through WAgN. WAgN has served as a model program for newly started WAgN's 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 Extension 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.

### **Dairy and Porcine Health and Agricultural Profitability**

A) Researchers are addressing costly bovine mastitis for dairy farmers (approximately \$200 per cow per year) by reducing the impact of the one-third of cases caused by coliform bacteria (primarily *E. coli*). Since antibiotic therapy is not very effective and vaccines have only limited effectiveness, and since the cows' aggressive immune responses to coliform infection may actually worsen the situation, researchers are determining whether a blunting of the innate

immune response to mammary infection caused by *E. coli* bacteria will actually enhance the ability of the cow to clear the infection. Researchers identifying genes involved in mastitis resistance in dairy cattle and demonstrating that the cell walls containing a coating of lipopolysaccharide (LPS) molecules known as endotoxin, are extremely sensitive to changes, and the innate immune response to these molecules includes mobilization of white blood cells, mostly neutrophils, to the site of infection, the production of acute-phase proteins, enhanced vascular permeability causing leakage of blood proteins into milk, and a fever which if not controlled can be quite detrimental to the cow. Researchers have determined that there is a fine balance between an effective response and one that is pathophysiological. Further experiments are examining whether treating cows with LPS binding proteins (via intramammary infusion) will blunt the response to an intramammary challenge with LPS. If successful, subsequent experiments will determine the response to challenge with live *E. coli* bacteria. Although the LPS binding protein used in our first experiments in dairy cows was not able to blunt the response to LPS, even when the dose of the binding protein was increased tenfold, researchers are now investigating a second LPS binding protein, and preliminary data in a cell

B) Researchers have determined the location, structure, function and expression of genes affecting health, reproduction, production, and product quality in cattle. They have interpreted and applied genomic and proteomic information by developing statistical methods and utilizing molecular tools to study cattle. And they have developed and delivered educational materials about bovine genomics research to consumers and stakeholders. Glucose uptake by the milk-producing cells in the mammary gland is a rate-limiting step for milk production because glucose is the major precursor of milk lactose which, in turn, controls milk yield. Regulation of glucose transport in the mammary gland and compensatory regulation in other tissues provides the key role in maintaining glucose homeostasis during lactation. This work lays the groundwork for future studies aimed at unraveling the functional roles of bovine glucose transporter in supporting milk synthesis and maintaining glucose homeostasis during lactation. In a broader sense, our work will contribute to the knowledge base on glucose utilization, and, ultimately, to the improvement of dairy productivity and efficiency.

C) Researchers have conducted several studies to investigate nutritional strategies to reduce the leading cause of illness and death in young calves, enteric disease, the cause of almost 50 percent of all calves that die before weaning, and to support future milk production and herd profitability. An investigation into the long-term effects of varying the amount of milk replacer fed to neonatal calves on their future milk producing ability demonstrated that clear differences in early growth occur between the calves fed a milk replacer containing 20 percent crude protein and 20 percent crude fat and those fed a higher protein milk replacer at higher levels. A study examining the effect of a single-dose lactoferrin supplement on immune system development in calves. Showed a trend for an earlier peak in immunoglobulin levels in calves fed 4 g of lactoferrin with their first feeding. Further studies are being conducted to elucidate the relationship between passively acquired immunity (from colostrum) and immune function in calves.

D) Researchers have addressed the major animal health problem associated with profitable pork production, that is, piglet growth limited by milk production by lactating sows, by better understanding how prolactin acts on the mammary glands of swine to increase the potential for

modulating milk production. Researchers have been able to show that the prolactin receptor localizes primarily to either the cell surface or lysosomes, and further research results suggest that the porcine prolactin complex has unique differences from that in other species. By investigating the physiological regulation of prolactin receptor expression *in vivo*, using tissues from swine at different stages of development, and different tissues from these animals, researchers have found that prolactin receptor expression increases during gestation in the mammary gland and has highest levels in this tissue compared to other sites such as uterus and ovary. By resolving the genetic and biological properties of the porcine prolactin receptor it will be possible to pursue this gene as a genetic selection tool in swine. Furthermore, by understanding its biological function at the cell and molecular level it will be possible to modulate the effect of prolactin that is a critical hormone for various production traits such as reproduction and lactation, and to help select for animals with increased productivity, or to genetically modify animals for increased production.

### **Modernizing Strategies for Precision Agriculture Against Pests and Invasive Species**

A) Research between VT, NH, and ME, was conducted on utilizing indicator plants to optimize timing of early detection and treatments to contain thrips populations with a minimum of intervention. Western flower thrips (WFT) is a major pest of greenhouse ornamental crops and few pesticides are available. When growers are able to detect WFT early, before they reach damaging levels, they have greater potential to use biological controls successfully and can produce higher quality plants. Knowledge of WFT daily activity patterns enables growers to apply pesticides more efficiently, reducing the need for multiple routine applications. Research has shown:

- indicator plants with a very low thrips population can be kept in a greenhouse for at least 4 weeks before becoming a source of an outbreak; and
- thrips larvae were more active in the evening, making this an ideal time to spray a pesticide.

Research results were shared with more than 100 greenhouse growers in five workshops. A non-flowering crop of New Guinea impatiens, western flower thrips was detected three weeks earlier in an early spring on flowering marigold indicator plants than on yellow sticky cards, and growers reported that they used information from the indicator plants to treat a thrips outbreak early in the season during FY2006, thereby reducing the problem all the rest of the season.

B) Researchers working with other northeastern states are utilizing soybean cyst nematode (SCN) as a model system for development of the principles of invasion biology of soil-borne pathogens and soil invertebrates in general. This knowledge is being used to develop new and innovative practices to both minimize losses caused by SCN and decrease risk to other invasive species that are not currently of significance in the region. In the United States, SCN caused more estimated total yield reduction in soybean from 1999 to 2002 than any other disease. While previous research conducted on the management of plant-parasitic nematodes focused on the effects of economically important plant-parasitic nematodes in production fields where the soil was tilled, and pesticides used to control weeds and insects, current and future management of plant-parasitic nematodes must rely on understanding the biology of the nematodes as they interact with microbes and microfauna in soil communities. Crop production techniques have

changed as attempts to reduce soil erosion lead to reduced or no tillage. Therefore, researchers are developing alternative controls based on biological control and cultural practices, investigating the genetics of pests and hosts to identify new and different vulnerabilities that can be exploited in pest control strategies, refining and developing rapid and positive pest detection and identification techniques to enhance the capability to predict the occurrence and magnitude of pest populations/infestations/infection, and reducing our reliance on pesticides and the risk of human, animal and environmental exposure to pesticides.

## **Appropriately Addressing Consumer Needs for Information and Infrastructure**

A) Researchers used survey research with consumers, individual in-depth interviews with food buyers in grocery stores, and statistical and qualitative methodologies to analyze data on attitudes, knowledge and behaviors related to genetic, chemical, and antibiotic modification of food, and to estimate willingness to pay for information about agricultural biotechnology. Using both market and consumer data, multivariate Hedonic analysis shows that consumers are willing to pay a premium for both rBST free and organic milk. The willingness to pay for rBST free milk, however appears to be higher than the premium currently charged in the marketplace. Consumers are both willing to pay for information, and for the characteristic 'GMO-free'. Only about 10 percent of consumers actively seek information related to genetically modified ingredients in food. However, the percentage has increased and researchers expect to see it increase even further. On a national level, consumers are less aware of genetically modified products compared with Vermonters and appear less concerned, though consumers across the country continue to believe these products should be labeled in the marketplace. In multivariate analyses, it appears that consumers' attitudes and knowledge are more important predictors of behaviors associated with genetically modified food purchases than are demographic characteristics. Data showed that FDA standardization of labeling for rBST created an opportunity for information versus reaction-based decision-making to occur on the part of consumers, while providing some farmers with a niche market. The lack of similar standardization for GMO foods has potentially worked against farmers desiring to develop niche markets, and may create more reactive versus pro-active purchasing decisions on the part of consumers.

B) Using a recent national sample and controlling for demographic characteristics, researchers found that eating more than one fast food meal per week increases the probability of being overweight, as does leading a sedentary life as measured by increases in hours of television watched. Self reports of 'leading an active lifestyle' and 'making healthy eating choices' contribute to decreases in the probability of being overweight. Increases in the number of restaurant meals that are not characterized as fast food, and specific exercise regimes do not necessarily affect the probability of being classified as overweight based on BMI. A final year of the project will consist of refining both the model and econometric specification and testing it on a 2007 national sample to better describe a model of the relationship between the nation's food system and obesity. Understanding of the magnitude of the effect of various food system variables on overweight will aid in the development of education, infrastructure, and policy initiatives that can help stem the rising tide of obesity in the United States.

## **Improving Youth Development, Health, Technology and Environmental Quality**

A) The UVM Extension-sponsored Watershed Alliance (UVM-WSA) assists teachers and students in VT and NY to learn 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. In addition to coordinating more than 60 watershed education and monitoring sessions since 2002, with more than 1,700 students covering 40 streams and waterways within eleven watersheds of Vermont, the Watershed Alliance strengthened

watershed education programming in the State by focusing on teacher education. Outcomes include the following:

- During the 2005/2006 school year, all of the 1,168 fifth through twelfth grade students in 17 schools who participated in the University of Vermont Watershed Alliance (WSA) Watershed Education and Stream Investigation programs, working with eleven students from the Rubenstein School of Environment and Natural Resources (RESNR) as interns, showed a substantial increase in water quality knowledge, and 87 percent of students stated they will change their behavior in the future to protect water quality, and correctly identified at least two ways to do so.
- An on-line tracking system that can be used by all volunteer water-quality monitors in Vermont has been developed – students have been entering data since 2005 during Watershed Alliance stream monitoring field trips online from any computer using their school password., and any person with internet access can view data, so schools can compare their work with others' work around the state ( [www.vtwatergateway.org](http://www.vtwatergateway.org) )
- The Watershed Alliance program was highlighted in the recent Vermont Department of Environmental Conservation publication titled "Vermont Volunteer Surface Water Monitoring Guide". The guide listed the Watershed Alliance as a leading water quality education and monitoring program in the state. The guide also listed the Vermont Water Quality Gateway as the only online water quality database for use by students in the state.
- Each semester, five to six interns lead five hour watershed education and monitoring workshops in more than 20 classrooms around the state. They are the engine driving the program, are important technical resources for the educators, and great mentors for students. Every intern expressed how valuable their internship experience has been; over half of the interns return for additional semesters with the Watershed Alliance, and many have written letters after leaving describing how their experience as interns with WSA helped them to obtain their first job.
- Teachers report that student not easily reached in other educational settings really responded positively to the WSA program, and the students themselves responded by requesting more stream monitoring field trips with the Watershed Alliance

Data are being used, through Sea Grant and other partnerships, by UVM, ECHO at the Leahy Center, and NY researchers, to develop baseline and longitudinal data on Lake Champlain water quality indices.

B) Working with a KY-based Children, Youth, and Families at Risk (CYFAR) Program (CYFAR) liaison, and people from IA, AZ, and Penn State, technology and lifeskills after-school projects have been initiated and expanded to expand caring communities, engage youth in communities, and increase opportunities for youth to develop lifeskills and practical technology skills During FY2006, in-kind (\$170,543) and cash match (\$139,612) provided for \$310,155 to fund 43 new programs and expand and 31 existing programs, with 58 volunteers supporting programs delivered, and 59 community collaborators participating. Nearly 1,000 youths (936) were reached with lifeskills development programming, including four new technology-based after-school programs, and 72 percent of participants indicated they made at least one behavioral change related to lifeskills development as a result of participation.

C) Focusing on the topic of food safety in middle school children is particularly important. In a few years, many of these students will be working in the food service industry and cooking for their families. In addition, at this age, many students are beginning to make their own food preparation and purchasing choices. As a result, it is essential that they possess the necessary food safety skills and knowledge to make healthy and safe choices. UVM researchers worked on a national level to develop a highly interactive, multimedia, self-paced online resource for delivering an established food safety curriculum to middle school children, and are now in the process of testing the effectiveness of this program with approximately 500 middle school children from around the country. The effectiveness will be determined using validated cognitive and attitudinal evaluation instruments. Researchers are also measuring student learning styles and comparing student attitudes and cognitive gain with individual learning styles. Five-hundred middle school children are currently using the UVM -developed interactive, multimedia, self-paced online resource tools and utilizing a UVM-created online learning environment that can be applied to helping students learn any number of different topics. Researchers are identifying and exploiting those aspects of information technology that have the greatest potential for use in a learning environment. This project will provide a template for teaching other topics through an engaging and stimulating Web-based application.

## **F. Integrated Research and Extension Activities**

### **Improved Agricultural Niches for Vermont Farmers**

A) UVM Extension and VT-AES developed the first combined research and outreach program to assist early-adopters of **cold-climate viticulture**. 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 progress and outreach success have led to UVM's selection as a participant in a nation-wide grape cultivar adaptability study.

B) UVM researchers and outreach specialists have joined forces with undergraduate and graduate students to develop **certified organic orchards**, rare due to insect and horticultural challenges, as well as disease challenges associated with the predominant cultivar grown in New England, MacIntosh. A multi-disciplinary, multistate research project is examining budgets and other informational publications for producers on organic apple production including a full risk analysis of the impact on production, marketing, financial, legal, and human resource risk. Research is also focusing on two major production systems growers would use in changing to new cultivars and to organic production, and includes a closely integrated organic apple extension program to disseminate research findings, information, and insights, along an Organic Fruit Production course involving hands-on organic fruit production activities for students.

C) Vermont is working with farmers to develop and test **cold-climate-adapted apple rootstocks**. Tree maintenance and data collection for the 1999 planting of the NC-140 Cornell/Geneva Apple Rootstock Evaluation continues at the University of Vermont Horticultural Research Center, as trees are trained, pruned and maintained according to protocol developed by the principal researchers. Although there has been a reduction in total hectares planted with apples over the last ten years, production has remained the same indicating an increase in efficiency and productivity, attributed in part to the trend towards higher density

plantings based on grower selection of dwarfing or semi-dwarfing rootstocks. Data have shown that one rootstock series (CG) outperforms another (EMLA) in precocity and yield. In addition, observations of winter damage assessment are assisting researchers in developing appropriate genetic selection practices that extend the ability of apple trees to survive winter in areas such as Vermont where cold temperatures can be a limiting factor in maintaining steady crop production.

D) Research and outreach are helping growers to improve their ability to **grow cold-climate-adapted perennials** in Vermont and similar northern climates, so that plants are not lost to cold damage each year. A project examining the effects of various freezing durations, and various conditions prior to freezing, on subsequent survival show few differences in winter survival to moisture for three perennials, with current studies investigating this factor on three moisture-sensitive Sedges. Additionally, five Miscanthus cultivars were tested to show varying survival and regrowth levels when exposed to subfreezing temperatures. Growers have used this information to better control and predict losses of plants in nurseries.

E) A research and outreach project is devising **strategies for maple producers** to maintain high system yields over a longer period of time, and to determine the economic lifetime of a mainline/tubing system, since it has been found that maple sap yields typically decline each year after a mainline and tubing system is installed (approximately 50 percent loss within five to ten years after installment), but causes for this decline are unclear. Researchers are working directly with maple producers to compare annual sap yields (quantity and quality) from systems installed in 2005 on twelve maple tree plots, with different management strategies to determine which shows the largest effect on maintaining high yield. The experimental trials involve replacement and/or cleaning of spouts and droplines, and differences in materials (plastic or stainless steel). This research will help maple producers by improving our understanding of how different sap collection methods affect sap yield, and will also help to determine when retubing a sugarbush is economically viable.

F) Information collected, analyzed, and shared between UVM researchers and outreach specialists, is helping farmers decide whether it is in their interest to maintain or transition to organic dairy farming. Researchers from Maine and Vermont assessed current financial and production **status of Vermont and Maine's organic dairy** from 30 randomly selected organic dairy farms, examined transitional costs, and developed benchmarks for organic dairy farms. Researchers also published reports, fact sheets, and educational material for farmers, lenders, service providers, policymakers, and the public. The study revealed that organic milk prices remained practically unchanged from 1999. However, expenses jumped from \$18.20 to \$22.58 per hundred-weight. The bottom line was that net farm revenue for organic dairy farms dropped 42 percent from \$38,364 in 1999 to \$21,898 in 2004, and fared worse than conventional farms in 2004. However, in 2003, when milk prices were not at an all-time high, organic farmers fared as well, or better, than conventional farms per cow. This was the first economic study conducted for organic dairy farmers, transitioning dairy farmers, and dairy farmers thinking about moving to organic production. Now the more than 90 Vermont dairy farms currently in transition to organic dairy production are being provided information about the costs of transitioning, and when, and if, profits would be expected from their organic dairies.

G) Prompted by a query from Vermont Sustainable Agriculture Council, who wanted to know how much of Vermont's current food supply originates within the state, UVM researchers are **assessing current local-food efforts** in the State of Vermont, analyzing alternative marketing channels and strategies for local food production and consumption, and providing information and recommendations for increasing production, purchases, and consumption of locally grown food in local communities. While results suggest that a possible upper bound on Vermont's local food is 38 percent, input-output models such as IMPLAN suggest that the actual local food amount is in the 10 to 15 percent range for Vermont. However, the best indicator of consumer interest in, and demand for, local foods may be per-capita direct food sales -- those sales from farmers markets' and farmstands, and Vermont is a national leader in this area, with 5.5 times the national average per-capita direct sales, suggesting that Vermonters are particularly inclined toward consuming local foods. When a regression model was estimated to better understand how and why direct food sales vary across the country and across the state, results suggest that direct sales:

- increase as average farm size decreases,
- increase with population density (except in the most densely populated U.S. cities),
- increase with amount of farmland available, and
- vary significantly by region of the country.

Using these four variables, the model predicts state-level direct sales with 92 percent accuracy, and the model is being applied to county-level sales in Vermont, to assist Vermont counties with lower than expected direct sales in developing opportunities for increases, and utilize information from best-performing counties to suggest a possible range of direct-sales increases for the state.

H) A project between UVM Extension and VT-AES has personnel working with communities to investigate the **economic and land use effects of small-scale agriculture** in Vermont as well as exploring what may be the beneficial impacts of providing key entrepreneurial resources to rural communities. Researchers are measuring the economic contributions, local food production capacity, land use, and development implications of local and regional effects small-scale agricultural establishments in Vermont, and of rural broadband Internet service, agricultural e-commerce options, and online rural community indicator information. UVM's Center for Rural Studies (CRS) is:

- developing a survey instrument to research small-scale agriculture operations and the amount of land they use, how it is used, what development pressures may be at play, and what that land may be used for if not in production, with the goal of producing knowledge on land use and development implications of agricultural entrepreneurship in Vermont – to be first conducted within the Women's Agricultural Network, and then expanded to farmer's markets and other networks;
- forming an arrangement with the Intervale Foundation in support of their Farm Incubator Program, which has graduated six farm ventures that are now operating outside of the intervale and has cultivated farming skills in many dozens of individuals involved in various food production/security activities throughout the nation, to support the

evaluation of fledgling and mature farms moving in and out of the program, measuring their production, visitor attraction, employment and impact on the local economy;

- supporting the Vermont Council on Rural Development (VCRD), to incorporate community-level broadband provision solutions in 15 rural Vermont towns, complete already initiated broadband projects in 10 communities, and advance the development of broadband solutions in the 35 communities still in-process; and
- collaborating with the Vermont Fresh Network (VFN) to study the feasibility of creating a substantial new e-commerce tool for small-scale agricultural businesses -- an on-line food ordering and invoicing system matching local producers to restaurants, wholesalers and other consumers.

### **Improved Pre-Weaned Calf Health and Survivorship**

UVM Extension and VT-AES funds were combined to evaluate and develop nutrient utilization schemes for dairy herd replacement heifers with implications to economic efficiencies and environmental impacts, and to develop strategies and systems to optimize nutrient utilization, economic and financial returns, and environmental goals for management of dry, pregnant and lactating dairy cows in Vermont and New York. Early results in the four-year study show clear differences in early growth between calves fed a milk replacer containing 20 percent crude protein and 20 percent crude fat and those fed a higher protein milk replacer at higher levels, and an earlier peak in immunoglobulin levels in calves given a single-dose of lactoferrin supplement with their first feeding. Further studies will be conducted to elucidate the relationship between passively acquired immunity (from colostrum) and immune function in calves to reduce the highest cause of

### **Improving Student Learning and Food Safety Using Technological Advances**

UVM is working with middle schools across the country to develop and evaluate the effectiveness of a multimedia, highly interactive, self-paced, online computer program for teaching food safety to 500 middle school children, and comparing outcomes to those occurring from using the same curriculum delivered via a traditional lecture-based format, with effectiveness determined by developing and validating both cognitive and attitudinal evaluation instruments, and by comparing cognitive retention at three and six months following completion of the program, between students who received the online format versus those that were taught via the lecture-based format.

### **Assisting Farmers in Improving Water Quality**

A) UVM researchers have developed an approach to identify, analyze, and map high-risk areas for phosphorus (P) export from agricultural lands by integrating spatial data (e.g., soil characteristics, digital elevation models (DEM)) with land use and agronomic data (e.g., P application rates, cropping patterns). The temporal and spatial relationships that define the risk of P export are captured simultaneously using a raster-based distributed dynamic modeling approach and related to management interventions. Predicted response to management interventions are analyzed and displayed spatially through a geographic information system (GIS). The framework allows the spatial distribution of P runoff risk to be tracked through time

in response to long-term P input/output balance, resulting from either continuation of current practices or scenarios of targeted management changes. The tool is assisting scientists and watershed managers to target management interventions to critical source areas that present high risk of nutrient loss to water, and to visualize anticipated responses to management over time. Phosphorus infrastructure and specific parameter values were determined from a number of sources including published literature data, local agronomic and environmental statistics, values estimated or extrapolated from agricultural soil tests conducted by the UVM Agricultural Testing Laboratory, as well as knowledge from researchers, professionals, farmers, and other regional and local stakeholders. Throughout the process, project investigators have worked with an advisory committee that includes representatives from state and federal agencies, agricultural professionals, conservation groups, and land use planners. Results of the project are providing guidance regarding the development of regional programs designed to reduce the phosphorus deposits in Lake Champlain.

B) UVM Extension evaluated the potential of alternative high yield and quality annual forage crops to improve or maintain water quality, since lack of rotation out of corn silage has led to a number of potentially detrimental economic and environmental consequences including lowered water quality. In 2004, strip plots were established on two fields located on farms in Grand Isle and Addison counties that had undergone at least three years of continuous corn silage production. Treatments included five cropping systems utilizing a randomized complete block design with four replications, creating 20 strips (experimental units) per location. Within each sampling area, percent residue and cover were estimated using the line-transect method, and changes in soil health were assessed by monitoring soil active carbon, total carbon, respiration, infiltration, bulk density, earthworm counts, and aggregate stability. Indirect measurements of the water quality were made by comparing pesticides applied, crop residue cover, changes in soil health and the crop nutrient balance of the different systems over the study period. Yield and quality of forages was measured, and animal performance indices (milk per ton and milk per acre) were used to evaluate the economic value of the forages. The net value of the proposed alternative cropping systems minus conventional corn as well as the input costs of production of each cropping system will be used to determine a net economic return. Results from this project will help farmers use more environmentally sound field management practices, resulting in decreased phosphorus in surface waters.

**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**  
**Fiscal Year: 2006**

Select One:  Interim     Final

Institution: University of Vermont Extension and Agricultural Experiment Station

State: Vermont

	Integrated Activities (Hatch)	%	Multistate Extension Activities (Smith-Lever)	%	Integrated Activities (Smith-Lever)
<i>Established Target %</i>					
<i>This FY Allocation (from 1088)</i>					
<i>This FY Target Amount</i>					
<hr/>					
<b>Title of Planned Program Activity</b>					
NGA 1	\$289,542		\$406,310		333,650
NGA 2			\$31,313		40,233
NGA 3			\$4,688		134,976
NGA 4	148,487		\$256,917		315,823
NGA 5	308,250		\$106,220		0
<b>Total</b>	<b>\$746,279</b>		<b>805,447</b>		<b>824,682</b>
<b>Carryover</b>					

**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.

*\*Dollars reflect budgeted dollars. Prior to July 1, 2007 actual dollars will be reported.*

*Permission for extension given by Robert MacDonald.*

\_\_\_\_\_  
**Director**

\_\_\_\_\_  
**Date**

**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: 05 ~~REVISED\*~~ \_\_\_\_\_**

**Select One:**      **Interim**    **X Final**  
**Institution:**    University of Vermont Extension and Agricultural Experiment Station  
**State:**            Vermont

	<b>Integrated Activities (Hatch)</b>	<b>Multistate Extension Activities (Smith-Lever)</b>	<b>Integrated Activities (Smith-Lever)</b>	
<i>Established Target %</i>	_____	_____	_____	%
<i>This FY Allocation (from 1088)</i>	_____	_____	_____	
<i>This FY Target Amount</i>	_____	_____	_____	
<b>Title of Planned Program Activity</b>				
NGA 1	_____	_____	318,081	
NGA 2	_____	_____	45,763	
NGA 3	_____	_____	86,129	
NGA 4	_____	_____	300,964	
NGA 5	_____	_____	117,287	
<b>Total</b>	=====	=====	868,224	
<b>Carryover</b>	=====	=====		

**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. *\*When reviewing FY05s submission the values for Integrated did not seem correct, upon reviewing backup notes this was confirmed. Corrected numbers are reflected here. All other data is valid as reported.*

\_\_\_\_\_  
**Director**

\_\_\_\_\_  
**Date**