2016 University of Vermont Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

UVM Extension (EXT) and the Vermont Agricultural Experiment Station (AES), housed within the College of Agriculture and Life Sciences (CALS), integrate higher education, research and outreach to meet the changing needs of Vermont citizens, communities, and organizations. Together, we work to protect and enhance a quality of life characterized by a healthy natural environment, vibrant economy, strong sense of community, resilient youth, and a deeply ingrained connection to agriculture.

This year marks the reintegration of EXT into CALS. In the past, EXT and AES were standalone units, each led by a Dean and Director who reported directly to the Provost. The Dean of CALS is the Director of AES, and EXT's director held the dual title of Dean. A new Director of EXT now supports the Dean of CALS and together they meet to discuss programming and to maintain a collaborative and cooperative approach to addressing the applied research and outreach needs of agriculture across Vermont.

Our multidisciplinary work and integration of research and outreach continue to fall within and across our planned programs. Because of this and due to the overall size of our planned programs, it is once again most practical to report the bulk of our efforts within the NIFA Global Foods Security and Hunger priority area. Since we do not necessarily have programs of sufficient size to divide neatly into other priority areas, we have chosen to report the majority of our efforts within Global Food even if we could allocate some part of the work to other NIFA priority areas. The Global Food program area encompasses a wide variety of work conducted at UVM, ranging from cost of health insurance and childcare, to future U.S. agricultural production, to improving the viability of dairy through hay crop harvest and silage management.

Strengthening economic development is among our critical priorities, and we believe science is an essential part of innovation and technology in Vermont's economy. Our efforts support many industries that produce signature Vermont products such as maple, apples, milk, artisan cheese, hard cider, wine, artisan beer and ice cream, to name a few. Sales of these products bring millions of dollars to the Vermont economy. Research and outreach provide support through workshops, site visits and electronic communications to assist with pest and other risk management.

AES and EXT help solve some of the most pressing issues surrounding 21st Century farming, food systems that work, and building Vermont communities. This year, we delivered more than 2,000 educational activities designed to improve the sustainability of Vermont businesses to 28,600 points of contact. This work resulted in the implementation of 2,072 recommended practices by businesses across the state. The impact of these recent and past research-based improvements continue to present themselves. For example, nine commercial vegetable farms made improvements to the design and management of their post-harvest crop storage facilities. Results over a two-year period were substantial: the market value of crops stored in these facilities was $3.5 million, and the new systems reduced historical losses from 15% to 5%.

We invest significant effort to help grow and maintain a viable market for local and regional food producers and processors of vegetables, meat, and manufactured food products. These efforts span from safe

production, to safe storage, to safe processing and distribution. The work can range from developing and applying good agricultural practices, to research on the rapid detection of food borne pathogens, to developing new opportunities for artisanal cheese makers, or working to understand disease resistance in dairy cattle. Our Food Safety Program conducts research, disseminates information and provides consultations to improve the safety of food in and around the state. This support allowed 20 food producers to create and/or implement new practices from their food safety plans this year, and was instrumental in the successful opening of two new businesses - a meat processing plant and a sauce manufacturing facility - in Vermont.

Vermont's agricultural working landscape symbolizes a way of life strongly cherished by its citizens. These citizen stakeholders recognize the value of Vermont's agriculture and the need to protect our air, water, soil, and human health resources. We address these critical stakeholder issues by conducting research and disseminating essential current science-based information to a broad range of audiences to increase their knowledge and skills and encourage implementation of cost-effective, environmentally sound sustainable agricultural practices. Improving long-term soil health and protecting water quality in and around Vermont are current priorities. Our Nutrient Management Program (NMP) conducted 480 activities this year, assisting farmers and landowners with the implementation of practices to improve farm profitability and water quality protection. This year, farmers adopted 341 best field management practices, positively affecting more than 34,500 acres of cropland and associated livestock production facilities.

Investing in Vermont's future begins with some of our most valuable citizens: children and youth. According to "Advance Vermont," a state-based group addressing workforce needs, "26% of Vermont's Class of 2012 high school graduates had aspirations to go to college but did not do so." Our 4-H Youth Development Program helps young people in Vermont build life and job skills and provides opportunities for career exploration in a supportive environment. This year, 4-H involvement led to the mastery of life skills for 839 children and youth. A Vermont survey of 2016 4-H high school graduates showed that 90% believe their 4-H involvement helped them get into college; 75% indicated that 4-H helped them to develop interests for a future career. We recognize that today's youth are tomorrow's leaders and problem-solvers; our youth development programs demonstrate our commitment to growing this future generation.

The narratives and outcomes listed in this annual report again show the breadth and depth of EXT and AES work. From economic development to environmental protection, we follow the needs of our communities and stakeholders and rely on the expertise of our faculty and staff to meet them. Though we move forward with new structure, UVM Extension and the Agricultural Experiment Station continue to share a common mission of service and outreach for the citizens of our state.

Follow this link to see a copy of our Annual Report 2016:
http://www.uvm.edu/extension/annual_report_extension_quarterly_newsletter

Total Actual Amount of professional FTEs/SYs for this State

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	55.0	0.0	28.0	0.0
Actual	56.8	0.0	35.0	0.0

II. Merit Review Process

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

- External University Panel
- Expert Peer Review

2. Brief Explanation

Extension key staff have monthly telephone meetings with the four states that cooperated to develop an on-line planning and reporting system. These are an opportunity to get feedback on programs and statewide goals and initiatives. Discussions include regional programs, opportunities for multistate work, sharing staff resources and other programming strategies and issues. In addition, staff at the faculty and administrative level access the on-line system (https://lmprs.net) to view peers' work. Program staff, faculty and administration are active in regional and national discussions around program success and challenges.

UVM Extension is physically located in 11 of 14 counties and provides educational programs in all 14. Vermont's small towns and high level of citizen involvement create opportunities to connect with Vermonters to understand who is in their communities. Program participants are engaged in developing future programs through on-site data collection feedback tools

AES provides the opportunity for seed project funding through a competitive proposal process. Project proposals are evaluated for scientific and technical merit through a peer review process. Projects are intended as seed funding to aid the principal investigator (PI) in establishing a new research direction or to other organizations as available or interested.

The AES Director looks at a wide range of expertise and appoints individuals to serve on the CALS advisory committee who have experience in the area of dairy farming, state legislation, scientists, finance, marketing, to name a few. These individuals provide feedback to the Dean that identify research needs that are important to Vermonters.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of the general public

- Other (see narrative for details)

Brief explanation.

Many projects have advisory committees of one form or another that provide a sounding board and input on the current program issues and help prioritize programmatic direction. This input helps in all aspects of programming, including delivery method, outreach and content. Most events ask participants if the programming met their needs and expectations. Post-event evaluations, including six-month follow-up check-ins about behavior change, are standard practice for UVM Extension faculty and staff. This effort also provides an opportunity to gather further input informing future program effort.

A state advisory board meets with the Director and key staff two times per year. They meet with faculty and program staff to hear about programmatic efforts, needs and changes in behavior measured following the educational efforts. The Board serves in an advisory capacity directly to the Director. The members represent a broad perspective with diverse experience and backgrounds.

Partnerships with communities, public and private organizations, and businesses are important to reaching and serving clients with appropriate programming. These relationships remain a critical part of identifying needs and gaps for programming.

The Director of AES has an advisory board which meets twice a year to provide feedback and advice on future trends of agriculture and life sciences. The Director of Extension and Dean of Agriculture and Life Sciences (Director of AES) meet regularly and share stakeholder input relevant to their work.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Use Surveys

Brief explanation.

UVM Extension creates new and continues to develop existing relationships with organizations and agencies in an effort to encourage meaningful conversations. In a small state, relationships are critical in accessing key individuals with knowledge of current relative issues for Vermonters. A part of that effort are monthly group meetings among partners. These partners include leaders from USDA Natural Resources Conservation Service, Vermont Department of Agriculture, Vermont Association of Conservation Districts, USDA Rural Development, USDA Farm Service Agency, UVM College of Agriculture, UVM Extension, representatives from all three Congressional offices, and other organizations as available or interested. UVM Extension is physically located in 11 of 14 counties and provides educational programs in all 14. Vermont's small towns and high level of citizen involvement create opportunities to connect with Vermonters to understand who is in their communities. Program participants are engaged in developing future programs through on-site data collection feedback tools.

The College of Agriculture and Life Sciences/AES Dean/Director looks at a wide range of expertise

and appoints individuals in the advisory committee who have experience in the area of dairy farming, state legislation, scientists, finance, marketing, to name a few.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Survey of the general public
- Meeting with invited selected individuals from the general public
- Survey of selected individuals from the general public

Brief explanation.

UVM Extension works with focus groups, state advisory groups, and utilizes post-event and reflective data collection methods.

Individuals on the AES advisory board meet twice a year and provide information on future trends of agriculture and life sciences.

3. A statement of how the input will be considered

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

Brief explanation.

As a small state we know our citizens. Collected data is used to refine, remove or create new educational programs and delivery methods that will serve the needs of the state. UVM Extension has close relationships with state and local government, an asset when seeking input and when sharing expertise and/or concerns of citizens.

The AES advisory board provides a source of council to the Director, using member input to help formulate a research direction.

Brief Explanation of what you learned from your Stakeholders

Advisory board members provided Extension leadership with feedback and suggestions on budget considerations including creating more avenues of reaching potential donors, capturing program and participant data, best uses of available resources using technology, as well as capitalizing on our strengths in successful programming. Other areas that were worked on included improving food safety, quality and access around the state, promoting positive youth choices and practical changes in agriculture methods to improve and protect natural resources.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
1899576	0	1857072	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	1891587	0	1470280	0
Actual Matching	1897371	0	2411321	0
Actual All Other	7732280	0	377168	0
Total Actual Expended	11521238	0	4258769	0

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

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Climate Change

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%		20%	
104	Protect Soil from Harmful Effects of Natural Elements	0%		13%	
112	Watershed Protection and Management	0%		5%	
121	Management of Range Resources	0%		9%	
123	Management and Sustainability of Forest Resources	6%		23%	
125	Agroforestry	0%		6%	
131	Alternative Uses of Land	0%		2%	
132	Weather and Climate	19%		8%	
133	Pollution Prevention and Mitigation	43%		5%	
136	Conservation of Biological Diversity	0%		2%	
205	Plant Management Systems	0%		1%	
206	Basic Plant Biology	0%		2%	
601	Economics of Agricultural Production and Farm Management	18%		2%	
602	Business Management, Finance, and Taxation	14%		0%	
801	Individual and Family Resource Management	0%		1%	
903	Communication, Education, and Information Delivery	0%		1%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.5	0.0	4.0	0.0
Actual Paid	2.4	0.0	5.0	0.0

Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
78090	0	234503	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
78329	0	410937	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
319210	0	41823	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Invasive Pests - Monitoring of the Asian Long Horned Beetle & Hemlock Woolly Adelgid; interception and prevention if possible, mitigation through work with bioactive fungi and natural enemy species; and working with the US forest service, are all efforts to help prevent the integration of invasive species in Vermont. The spread of invasive earthworms has caused concerns for the ecosystem services provided by shedding or losing forests, potentially impacting forest buffers as well.

Maple Production - research and extension efforts at the Proctor Maple Center are directed at extending the sugaring season, maximizing yield, and minimizing disease to trees. Sugaring season has diminished by 10% due to climate change and research is being done on how to maximize yield.

Monitoring of the Eastern Forests - Species change and demarcation levels are being observed, documented and modeled for northern forests through remote sensing and on-the-ground observations.

Invasive Plants - research will continue on the genetic and physiological basis for "invasiveness" of problem plant species and introductions.

Climate Change Best Practices on Vermont Farms - in partnership with farmers, researchers are working to identify best on-farm strategies related to climate change adaptation for the Vermont Landscape, and evaluate the effects of these strategies on the economic health of farms, their environmental outcomes, and their contribution to resilience in the face of extreme weather events and other observed and projected climate change impacts.

Forest Health and Sustainability - works with mostly small forest landholders to make decisions that protect forest stands and the ecosystems within, mitigate fragmentation of forest lands and assist with forest land transfer.

Sustainable Transportation Project - Works with the transportation industry to promote the use of transportation options that reduce greenhouse gas and other harmful emissions, increase energy efficiency, and utilize alternation fuels and new technologies. Education and information are delivered through consultation, social media, on-line courses and certifications, and vehicle certification programs.

2. Brief description of the target audience

Agriculture: Apple Growers
Agriculture: Farmers
Agriculture: Government Agency Personnel
Agriculture: Maple producers
Agriculture: Produce Growers
Agriculture: Service Providers
Communities: Community Action Agencies
Communities: Non-Governmental Organizations
Environmental decision makers
Forest geneticists
Forestry: Woodland Owners
Hop growers
Natural resource managers
Public: Business / Commercial
Public: Forest land owners
Public: Immigrant population
Public: Professional Drivers
Public: Small business owners/entrepreneurs
Researchers
Watershed managers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	3062	3675	0	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total

Actual	0	2	2

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research projects focusing on climate change.

Year	Actual
2016	21

Output #2

Output Measure

- Consultations

Year	Actual
2016	515

Output #3

Output Measure

- Workshop Series

Year	Actual
2016	18

Output #4

Output Measure

- Mass Media: Blog post/Social Media/Web page/Internet site updating

Year	Actual
2016	124

Output #5

Output Measure

- Publication - popular press

Year	Actual
2016	12

Output #6

Output Measure

- Education - Presentations

Year	Actual
2016	8

Output #7

Output Measure

- Workshop - single session

Year	Actual
2016	11

Output #8

Output Measure

- Education - Field Day

Year	Actual
2016	1

Output #9

Output Measure

- Seminar

Year	Actual
2016	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of climate change management practices identified for Vermont farms that aid in climate change adaptation.
2	Number of ecological and evolutionary factors identified that influence invasive plants in Vermont
3	Number of landowners who actively engage with their land to protect/improve/create woodlands
4	Number enterprises who implement recommended environmental behaviors to meet or exceed terms to have vehicles certified through the eRating program
5	Number of new and continuing Enterprise/Organizations offering CST 'eco-driver' and/or 'idle free' themed certification courses to employees and related stakeholders in order to promote saving fuel, money, and reducing environmental impacts.
6	Number of individuals who implement one or more best practices that mitigate the effects of climate change for farm, forest, or garden
7	Number of research projects that studies the adaptation of the genetic variation of the Vermont red spruce forests as a consequence of climate change.
8	The number of small-parcel (under 25 acres) forest landowners developing a management plan and goals to minimize the threat of forest fragmentation

Outcome #1

1. Outcome Measures

Number of climate change management practices identified for Vermont farms that aid in climate change adaptation.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Vermont is predicted to experience increased precipitation, flooding, droughts, and extremes in weather and temperature due to climate change. Climate change is expected to impact farming through precipitation increases, changes in crop suitability (e.g. apples) and decreases in milk production capacity. These changes will impact farm viability.

What has been done
This research focuses the use of climate change best management practices (CCBMPs) in Vermont agricultural landscapes. Through this research, focus groups and surveys have been used to identify stakeholder use of and interest in CCBMPs.

Results
Scientists analyzed data, including statistical analyses, from 133 surveys that took place at farm conferences and conducted three focus groups for opportunities to use landscape visualizations in communication among farmers, technical service providers and other stakeholders from public and private entities. The research will continue to do on-farm sampling related to greenhouse gas emissions from agricultural lands, and will analyze these data in the final year of the grant.

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
131	Alternative Uses of Land
132	Weather and Climate
133	Pollution Prevention and Mitigation
205	Plant Management Systems

601 Economics of Agricultural Production and Farm Management

Outcome #2

1. Outcome Measures

Number of ecological and evolutionary factors identified that influence invasive plants in Vermont

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pooids constitute approximately 3,800 species, containing many of the worlds most important crops; including barley, oats, rye, and tall fescue. Cool season grasses (pooideae) are a fundamental component of the native and agricultural Vermont flora, comprising the majority of forage, cereal, and turf grasses.

What has been done
This research aims to uncover the conserved and unique genetic bases for stress responses due to climate change across Vermont crop and wild species of temperate grass (pooideae).

Results
Data from research was completed to generate gene expression for three species of Pooideae to characterize and reconstruct the evolution of freezing tolerance across diverse Pooideae. Studies examine responses of cold, freezing, and drought to grass. Recent advances in diversified farming have helped and highlighted the need to increase native and crop diversity in order to foster ecosystem services, such as maintaining soil quality and increased biomass/yield, in the face of climate change.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
131	Alternative Uses of Land
132	Weather and Climate
206	Basic Plant Biology

601 Economics of Agricultural Production and Farm Management

Outcome #3

1. Outcome Measures

Number of landowners who actively engage with their land to protect/improve/create woodlands

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number enterprises who implement recommended environmental behaviors to meet or exceed terms to have vehicles certified through the eRating program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	49

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
More than 25% of carbon dioxide (CO2) emissions in the U.S. can be attributed to transportation activities; 73% of these emissions come from passenger transportation. There is a need to improve sustainability in the passenger transportation sector in order to address global climate change, the depletion of limited petroleum resources, negative impacts to regional and local air quality, increased traffic accidents, and traffic congestion.

What has been done
The Certification for Sustainable Transportation (CST) offers driver-trainings and certifications designed to help companies and individuals eliminate unnecessary idling while also promoting fuel-efficient driving practices. To date, CST has worked with approximately 91 transportation companies in 39 states, issuing approximately 12,700 vehicle/driver certifications to participants.

Results
Seventy-six transportation companies now offer certification courses to their employees because of their work with CST. Those courses resulted in pledges from 5,353 drivers to go "idle free" and 5,089 to embrace eco-driving practices. Forty-nine of those companies took an additional step

and certified 2,658 vehicles through CST's "eRating" program. By changing driver behaviors and improving the energy efficiency of their vehicles, transportation companies are positively impacting the industry and environment. The CST has reason to believe their programs help save a low estimate of 16,340,533.2 pounds of CO2 from going into the atmosphere annually. Those savings are roughly equivalent to the emissions from 1,566 passenger cars driven for one year (6,263 cars when using CST's high estimate of 65,362,132.8 pounds of CO2).

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
602	Business Management, Finance, and Taxation

Outcome #5

1. Outcome Measures

Number of new and continuing Enterprise/Organizations offering CST 'eco-driver' and/or 'idle free' themed certification courses to employees and related stakeholders in order to promote saving fuel, money, and reducing environmental impacts.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	76

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
602	Business Management, Finance, and Taxation

Outcome #6

1. Outcome Measures

Number of individuals who implement one or more best practices that mitigate the effects of climate change for farm, forest, or garden

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	60

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
132	Weather and Climate
601	Economics of Agricultural Production and Farm Management

Outcome #7

1. Outcome Measures

Number of research projects that studies the adaptation of the genetic variation of the Vermont red spruce forests as a consequence of climate change.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Climate change has already begun to affect the structure of our forests. Long-term monitoring of tree species composition has shown retreat of high elevation species upslope, as well as declines in abundance and productivity of climate-sensitive species.

What has been done
Data was collected on 540 trees on two mountains (Camel's Hump and Mt Mansfield) for the purpose of testing the genetic distinctiveness of high, mid, and low altitude populations and their adaptability.

Results
Forest geneticists predict that trees will respond to climate change through dispersal to track shifting environments, genetic adaptation to new conditions, or range contraction and decline. In Vermont, spruce has declined in abundance and shifted upslope in elevation in response to anthropogenic change. Data analyses are ongoing, and strongly suggest climate warming over the latter half of the 20th century.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
125	Agroforestry
132	Weather and Climate
136	Conservation of Biological Diversity

Outcome #8

1. Outcome Measures

The number of small-parcel (under 25 acres) forest landowners developing a management plan and goals to minimize the threat of forest fragmentation

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Vermont's forest landownership is changing. Trends in housing density suggest that the amount of land in parcels larger than 50 acres declined by 42,000 acres between 2003 and 2009, while the number of parcels between two and 10 acres increased by 4,300. Current educational and technical assistance programs have limited reach with this new and evolving audience. There is an opportunity to engage this transitioning audience as stewards of Vermont's changing forests.

What has been done
UVM Extension, with partners, developed the Backyard Woods Online Course to enhance homeowners' understanding of the importance of backyard woods for larger scale ecological health, specifically their contributions to Vermont's forested landscape. Delivered online over four weeks, the course targeted homeowners of less than 25 acres, specifically homeowners of 2-10 acres. The program was piloted in June 2016 to 13 participants in Washington County.

Results
Within one week of completing the program, five of the 13 participants submitted a backyard woods action plan, identifying stewardship goals for their property and steps to reach those goals. Additional plans are expected to be submitted and continued evaluation of the program will determine whether these participants implement management activities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Fluctuating energy prices have an impact on the marketplace and affect vehicle purchase price, driver behaviors, individual mode choices, the number of trips taken by an individual, the importance a transportation provider places on efficiency, profit margins and operating costs for transportation providers.
The political climate: changing policy and budget priorities may have an impact on public attitudes toward a program focused on increasing energy efficiency, reducing fossil fuel consumption, and reducing the environmental impacts of travel.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Sustainable Transportation Certification: the more enterprises that implement the recommended environmental behaviors to meet or exceed terms for Green-leaf certification will help move our passenger transportation system in a direction that reduces greenhouse gasses emitted per passenger mile traveled and reduces demand for petroleum fuel per passenger mile traveled.

An ongoing log tracks the number of enterprises registered in the program and the number of enterprises that have documented and met or exceeded the terms for Sustainable Transportation Certification.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Global Food Security and Hunger

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
133	Pollution Prevention and Mitigation	37%		0%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		4%	
205	Plant Management Systems	5%		18%	
206	Basic Plant Biology	0%		12%	
212	Diseases and Nematodes Affecting Plants	0%		3%	
216	Integrated Pest Management Systems	5%		3%	
302	Nutrient Utilization in Animals	0%		7%	
305	Animal Physiological Processes	0%		2%	
308	Improved Animal Products (Before Harvest)	0%		8%	
311	Animal Diseases	0%		7%	
312	External Parasites and Pests of Animals	0%		2%	
601	Economics of Agricultural Production and Farm Management	32%		13%	
602	Business Management, Finance, and Taxation	8%		0%	
604	Marketing and Distribution Practices	2%		1%	
605	Natural Resource and Environmental Economics	4%		3%	
609	Economic Theory and Methods	0%		5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	5%		0%	
723	Hazards to Human Health and Safety	2%		0%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%		7%	
805	Community Institutions and Social Services	0%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	5.0	0.0	15.0	0.0
Actual Paid	30.5	0.0	17.0	0.0
Actual Volunteer	7.7	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1016721	0	784560	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1019829	0	1123275	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
4156070	0	106746	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Extension project listed in bold followed by delivery methods:
Ag Business Management. Conferences, courses, consultations and farm visits.
Agricultural safety. Courses, consultations, and farm visits.
Engineering for Food Production, Harvest and Storage. Consultations, workshops, research, social media.
Extension Master Gardener. Course, train the trainer.
Farm and Forest Transfers. Workshops, consultations, farm visits.
Farm Viability. Farm visits, consultations.
Farming Alternatives. Workshops, consultations, farm visits.
Food Safety. Articles, workshops, consultations.
Forage and Pasture Management Education. Conference, farm visits, consultations.
GAP. Consultations, workshops.
Ground Work: Building Capacity to Provide Tractor Education. Curriculum, evaluation.
Maple Program. Conference, workshops, newsletter.
Nutrient Management Program. Farm visits, consultations.
Organic Grain Project. Demonstrations, data gathering.
Pest Management Education. IPM and Pesticide Education and Safety Program (PESP) training
Soil Health. Publications.
UVM Tax School. Conference, tax book.
Vegetable and Berry Growers. Consultations, farm visits, meetings, various media, presentations, website.
Vermont New Farmer Network. Conference, networking, consultations.

Vermont Pasture Network. Pasture walks, demonstrations and trials, conference, consultations, various media.
Vermont Tourism and Recreation. Research, conference.
Women's Agricultural Network. Newsletters, website, classes, workshops, individual and small group consultations.

AES Efforts:

- Animal Manure Treatment Systems
- Perturbation of soil ecosystems by anthropomorphic interventions
- Economics of organic dairy, crop management and alternative energy
- Heifer nutrition, rearing and management
- Dairy nutritional immunology
- Small ruminant production and management systems
- Innate immunity, DNA-based vaccines and mastitis prevention
- Hormonal regulation of glucose synthesis and milk production
- Functional genomics and photoperiod effects on hormonal cycles/milk production
- Explore ruminant lipid metabolism
- Crop harvest and silage management
- Identification of genetic traits that make species invasive
- Surveillance and prevention of spread of Asian Longhorned Beetle
- Management of thrips pests in forests and greenhouses
- Identification/control of fungal propagation
- Fungal biological plant protection, collection and management
- Explore microbial pesticides and fungal components as IPM strategies
- Plant development and pathogen resistance
- Identification of genetic traits that make species invasive
- Economics of agricultural production and farm management
- National health care impact on the agricultural community
- Alternative agricultural technologies to reduce fossil fuel use
- Maple crop management
- Food Systems
- Apple production

2. Brief description of the target audience

Academia: scientists, students
Agriculture/Natural Resources: Watershed-Based Organizations
Agriculture: Agency Personnel
Agriculture: Apple Growers
Agriculture: Beef Producers
Agriculture: Beginning Farmers
Agriculture: CCA & Crop Consultants
Agriculture: Crop Producers
Agriculture: Dairy Herd Feed Consultants
Agriculture: Dairy Producers
Agriculture: Dairy Professionals
Agriculture: Equine Producers/Owners
Agriculture: Farm Employees
Agriculture: Farm Families
Agriculture: Farm Managers

Agriculture: Farmers
Agriculture: Goat & Sheep Producers
Agriculture: Greenhouse Ornamental Growers
Agriculture: Home Gardeners
Agriculture: Industry Professionals
Agriculture: Livestock producers
Agriculture: Maple Industry
Agriculture: Maple Sugar Producers
Agriculture: Nursery operators
Agriculture: Ornamentals Industry Professionals
Agriculture: Produce Growers
Agriculture: Service Providers
Agriculture: Small Fruit & Vegetable Growers
Environmental Professionals: Environmental Managers
Food Industry: Food Service Workers
Food Industry: Handlers
Food Industry: Processors
Food Industry: Producers
Public: Adults
Public: Homeowners
Public: Master Gardeners
Public: Master Trainers
Public: Media Outlets
Public: People with Limited Resources
Public: Small Business Owners/Entrepreneurs
Public: Vermont Government Elected Official
Train-the-Trainer recipients: adults
USDA personnel

3. How was eXtension used?

The Farm Energy Community of Practice (CoP) of eXtension has partnered with NEWBio to disseminate and promote research-based resources to farmers, educators, community leaders, business, and the interested public. UVM Extension's eXtension Farm Energy Coordinator worked with NEWBio researchers, extension educators and a team of publication specialists to produce scientific resources that are easy for a lay audience to understand. These have been published on the eXtension Farm Energy site, integrating with existing farm energy information materials from a national network of specialists. Throughout the Northeastern states, NEWBio personnel are using eXtension Farm Energy to share their collective knowledge. This knowledge has been generated by the project's 167 collaborators at nine universities, three federal agencies, and nine industry partners.

The eXtension Women in Agriculture Learning Network created a new 3-part series on marketing which includes some of the new materials on consumer trends, pricing, and using social media.

The eXtension eOrganic Project was developed in collaboration with other organizations such as NOFA-VT and Organic Valley. It seeks input from producers and invites an advisory team of farmers to help develop the agenda.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	39976	616898	1571	0

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

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	7	16	23

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Class/course

Year	Actual
2016	30

Output #2

Output Measure

- Conference

Year	Actual
2016	25

Output #3

Output Measure

- Consultation

Year	Actual

2016	2668

Output #4

Output Measure

- Consumer Publication

Year	Actual
2016	8

Output #5

Output Measure

- Demonstration

Year	Actual
2016	8

Output #6

Output Measure

- Discussion group

Year	Actual
2016	26

Output #7

Output Measure

- Educational/evaluation instrument
  Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Electronic Communication/phone

Year	Actual
2016	1373

Output #9

Output Measure

- Field day/fair

Year	Actual
2016	9

Output #10

Output Measure

- Field site visit

Year	Actual
2016	46

Output #11

Output Measure

- Funding request

Year	Actual
2016	23

Output #12

Output Measure

- Presentation

Year	Actual
2016	84

Output #13

Output Measure

- Publication - curriculum

Year	Actual
2016	1

Output #14

Output Measure

- Publication - fact sheet

Year	Actual
2016	39

Output #15

Output Measure

- Publication - magazine article

Year	Actual
2016	26

Output #16

Output Measure

- Publication - manual

Year	Actual
2016	13

Output #17

Output Measure

- Publication - newsletter

Year	Actual
2016	27

Output #18

Output Measure

- Publication - newsprint article

Year	Actual
2016	82

Output #19

Output Measure

- Research project

Year	Actual
2016	56

Output #20

Output Measure

- TV segment/ATF

Year	Actual
2016	32

Output #21

Output Measure

- Technical Publication

Year	Actual
2016	27

Output #22

Output Measure

- Tour(s)

Year	Actual
2016	3

Output #23

Output Measure

- Train the Trainer trainings
  Not reporting on this Output for this Annual Report

Output #24

Output Measure

- Website development and updates
  Not reporting on this Output for this Annual Report

Output #25

Output Measure

- Workshop - series

Year	Actual
2016	196

Output #26

Output Measure

- Workshop - single session

Year	Actual
2016	348

Output #27

Output Measure

- Mass Media: Blog post/social media/web page/internet site updating

Year	Actual
2016	786

Output #28

Output Measure

- Trainee/Volunteer Delivered Programming

Year	Actual
2016	106

Output #29

Output Measure

- Publication: software

Year	Actual
2016	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	number of farmers that develop a nutrient management plan protecting water and soil
2	number of Master Gardener participants earning certification
3	number of farmers who implement best field management practices(s) crop/pasture, product, and/or soil productivity while protecting water, air and/or soil
4	Number of individuals who implement IPM practice(s) increasing the protection of water, air and/or soil
5	Number of individuals and business owners who implement recommended practice(s)that accomplish owner values and goals to improve/protect business sustainability
6	The number of individuals who complete a plan including preventative measures to secure animal health, food safety and public health protecting the food chain and market integrity
7	The number of growers who adopt new crop/plant variety(ies) resulting in maintaining or increasing sales
8	number of individuals who complete a business plan, start a business (within 18 months of planning) based on personal values, goals and business viability
9	number of participants who make an intentional, informed decision regarding starting a business based on feasibility, personal goals and values
10	Number passing the USDA GAPs audit to gain or maintain a market for their locally grown crop(s)
11	The number of growers growing organic crops increase revenues improving business sustainability
12	The number of producers who implement produce safety/food safety plans/practices to gain or maintain a market for their locally grown crop(s)
13	number of farmers who implement key element(s) of their nutrient management plan protecting water and soil
14	number of individuals who assess vulnerabilities and implement a practice to secure animal health, food safety, and/or public health protecting the food chain and market integrity
15	Number of individuals who implement recommended gardening practice(s) protecting water, air, and/or soil
16	Number of studies that examines the effects of sap extraction on maple tree growth and health
17	Number of research studies that provide insights into the metabolic adaptation to lactation (milk producing state) in dairy cows.

18	Number of health hold factors that influence the financial success of Vermont entry into farming.

Outcome #1

1. Outcome Measures

number of farmers that develop a nutrient management plan protecting water and soil

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	47

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

Outcome #2

1. Outcome Measures

number of Master Gardener participants earning certification

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	125

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

number of farmers who implement best field management practices(s) crop/pasture, product, and/or soil productivity while protecting water, air and/or soil

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	341

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Soil and phosphorus that moves off-site from agricultural lands in Vermont have been identified as major causes of degraded water quality in Lake Champlain. Nitrogen raises similar red flags for the Connecticut River. Farmers across the state want assistance modifying their practices to both benefit business and improve the quality of water and soil.

What has been done
The UVM Extension Nutrient Management Program (NMP) provides outreach education and technical assistance to farmers across the state to increase implementation of farm practices that reduce soil and nutrient losses to surface water. More than 480 NMP activities were conducted this year including field days, consultations, and demonstrations. Over 10,000 direct points of contact were made.

Results
As a result of these and other UVM Extension efforts, a total of 341 best field management practices were implemented this year, positively impacting more than 34,500 acres of cropland and associated livestock production facilities. Examples of changed practices include: cover crops are now growing between corn rows protecting otherwise bare soil from erosion; manure and fertilizer applications are being applied at rates and times that reduce the chance they would be lost into nearby water; and farmers are following nutrient management plans they developed, optimizing crop yield, minimizing costs, and protecting soil and water.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

Outcome #4

1. Outcome Measures

Number of individuals who implement IPM practice(s) increasing the protection of water, air and/or soil

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	296

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Commercial growers, home gardeners, and Master Gardeners need help identifying pests, disease problems, and best strategies for Integrated Pest Managment (IPM). Commercial pesticide applicators for field and forages need continual IPM and pesticide safety training to maintain their pesticide licenses.

What has been done
The UVM Plant Diagnostic Clinic (PDC) assists in the identification and control of pests and diseases. This year approximately 500 samples were submitted, not including emails and photos. Clinic clients were provided with timely diagnoses as well as practical information for control options. In addition, 75 participants attended the Commercial Pesticide Applicators Meeting to earn pesticide recertification credits.

Results
A survey of PDC clients demonstrated the effectiveness of their service: 72% of respondents indicated that the provided information helped them use an IPM strategy to manage their pest and/or disease; 50% said they were able to reduce their pesticide use as a result of the info received. The Commercial Pesticide Applicators meeting had similar impacts: 68% of respondents adopted or changed an IPM practice for the control of weeds, insects, and/or diseases. In total, 296 IPM practices were implemented. This is an important contribution to the local, state, and national IPM goal of improving agricultural profitability and sustainability while reducing the health and environmental risks associated with agricultural production.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

Number of individuals and business owners who implement recommended practice(s)that accomplish owner values and goals to improve/protect business sustainability

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2072

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agriculture in Vermont is becoming more highly diversified and represents a critical component of this state's revenue. Improved knowledge and skills leading to the adoption of new practices can promote economic sustainability of farms, forests, natural-resource-based enterprises, and communities.

What has been done
More than twelve UVM Extension programs (i.e. Farm Viability, New Farmer Network, and Tourism and Recreation) provide support and education designed to improve the sustainability of Vermont businesses. These programs delivered over 2,000 educational activities, including consultations, workshops, and presentations to more than 28,600 direct points of contacts.

Results
This year, program efforts resulted in the implementation of 2,072 recommended business practices. For example, nine farm businesses used business plans (completed through the Farm Viability Program) to apply for loans, grants and/or other sources of financing to make investments into their farm. From this group, eight commercial loans, two grant awards and two other finance requests were approved totaling $1,189,000 in financing. Similarly, ninety farmers and ranchers reported using knowledge gained through the 2016 Women in Agriculture Learning Network to improve planning, decision making, and business performance on farms and ranches that collectively manage over 30,000 acres of US agricultural land. Improvements like these can increase business profitability and better secure the financial future of agriculture in Vermont.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
205	Plant Management Systems
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices

605	Natural Resource and Environmental Economics
723	Hazards to Human Health and Safety

Outcome #6

1. Outcome Measures

The number of individuals who complete a plan including preventative measures to secure animal health, food safety and public health protecting the food chain and market integrity

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #7

1. Outcome Measures

The number of growers who adopt new crop/plant variety(ies) resulting in maintaining or increasing sales

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

number of individuals who complete a business plan, start a business (within 18 months of planning) based on personal values, goals and business viability

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

Outcome #9

1. Outcome Measures

number of participants who make an intentional, informed decision regarding starting a business based on feasibility, personal goals and values

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	18

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices

Outcome #10

1. Outcome Measures

Number passing the USDA GAPs audit to gain or maintain a market for their locally grown crop(s)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #11

1. Outcome Measures

The number of growers growing organic crops increase revenues improving business sustainability

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	24

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management

Outcome #12

1. Outcome Measures

The number of producers who implement produce safety/food safety plans/practices to gain or maintain a market for their locally grown crop(s)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food-related recalls or outbreaks can be devastating to food processors, resulting in lost markets for their products and liability due to illness or death. Therefore, helping the industry with food safety plans is an important need for the state. These plans allow food processors to comply with federal and state regulations as well as provide an environment for producing safe products for sale.

What has been done
UVM Extension's Food Safety Program conducts research, disseminates information, and provides consultations to improve the safety of food in and around the state. More than 1,000 direct points of contact were made this year through 39 educational programs and events, including individualized support for Vermont processors creating their food safety plans.

Results
The food safety support from UVM Extension helped 20 producers create and/or implement new practices from their safety plans this year. Examples of those changes include: a maple sap water

facility conducted a microbial challenge study; a meat processor reformulated their brine process and smoking step to ensure the safety of the smoked bacon they produce and sell; and at least two food processors developed Hazard Analysis and Critical Control Points plans. The Food Safety Program also helped a meat processing plant and a sauce manufacturing facility to open in Vermont. By increasing their understanding of the importance of food safety and implementing new practices, producers are improving their place in the industry and positively contributing to Vermont's economy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #13

1. Outcome Measures

number of farmers who implement key element(s) of their nutrient management plan protecting water and soil

Not Reporting on this Outcome Measure

Outcome #14

1. Outcome Measures

number of individuals who assess vulnerabilities and implement a practice to secure animal health, food safety, and/or public health protecting the food chain and market integrity

Not Reporting on this Outcome Measure

Outcome #15

1. Outcome Measures

Number of individuals who implement recommended gardening practice(s) protecting water, air, and/or soil

Not Reporting on this Outcome Measure

Outcome #16

1. Outcome Measures

Number of studies that examines the effects of sap extraction on maple tree growth and health

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Maple syrup production is based on the premise that tapping trees to collect sap has no substantive detrimental effects on the overall health of the trees. Maple syrup producers need to know if tapping trees for sap collection will have a detrimental effect on the mortality of the tree.

What has been done
Research was done to compare sap yields from trees that were tapped and measured tree growth and taphole closure over three tapping seasons. Trees that were tapped with high vacuum yielded double the amount of sap as trees tapped on gravity.

Results
Research found no significant differences have been found in taphole closure of trees with gravity or high vacuum sap collection, or in growth between untapped to tapped with gravity or high vacuum.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #17

1. Outcome Measures

Number of research studies that provide insights into the metabolic adaptation to lactation (milk producing state) in dairy cows.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Glucose is the most important nutrient in milk production in dairy cows and is a major precursor of milk lactose. An average cow with milk production of 40 kg/day takes up to 3 kg of glucose from the blood daily. Glucose availability to the mammary gland and glucose uptake and utilization by the mammary gland are the rate limiting steps of milk production. In addition, improper metabolic adaptation to lactation often results in metabolic diseases such as ketosis and fatty liver. Agricultural dairy farmers and researchers would be interested in the research results to better understand milk production in cows.

What has been done
The study provided mechanistic insights into metabolic adaptation to lactation in dairy cows.

Results
Research found that insufficient supply of glucose is a major reason to cause reduced lactose synthesis in cows fed rice straw. This knowledge will lead to improvement in milk production efficiency while maintaining whole body glucose homeostatis.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
311	Animal Diseases

Outcome #18

1. Outcome Measures

Number of health hold factors that influence the financial success of Vermont entry into farming.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The aging of America's farm sector has spurred a new generation of policy and program initiatives to support beginning farmers, local farms and create economic development through food and agriculture at the national, state and local level. However, the majority of research, resources, programs and policy have been devoted to issues related to access to land, capital, credit, and market infrastructure.

What has been done
20 focus groups and 15 interviews across the Northeast with 60 farmers were conducted.

Results
There were two factors that this research found that influenced financial success; childcare and healthcare. 60.8% of farmers surveyed reported experiencing child care problems mostly related to affordability, availability, quality, or philosophy of caregiver. Most of farmers reported are likely to be beginning, young, and have small farms. Interviews demonstrated how different types of farmers face diverse types of health insurance issues. Older farmers use a combination of Medicare and private market insurance. Many cited planning for health costs in retirement as a challenge. Younger farmers may cover children through the state-run Children's Health Insurance Program (CHIP) where parents qualify based on income, however that is only for children. Parents often have difficulty providing insurance on themselves.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

805 Community Institutions and Social Services

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Soil building takes time and on some farms, investments in soil quality will take more than the duration of the project to show results.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Summary of No-Till and Cover Crop Symposium Evaluations - 2016: The conference was well received by attendees. Participants who filled out evaluations ranked the conference an average of 4.6 out of 5 for satisfaction. We were able to gather valuable data about changes in practice adoption, changes in knowledge, and future topics attendees would like to know more about when it comes to no-till, cover cropping and soil health practices. This educational event seems to be well-received by farmers and service providers. It continues to evolve as farmers learn more and adopt more of these practices. We have found that we need less 'big picture' content, as now folks want more advanced topics relating to the details of successfully implementing these practices.

Vermont Tourism and Recreation Workshops and Conferences Evaluation: Between October 2013 and September 2015, ten workshops were conducted with support from a grant from the Federal State Marketing Improvement Program (FSMIP). The workshops attracted a total of 509 participants, of which 168 were farmers from Vermont. The remaining attendees were agricultural service providers, educators, non-profit or government agency staff, researchers, food or tourism entrepreneurs, or consultants.

According to follow-up surveys six to 12 months after workshops, three-quarters (75%) of respondents reported a positive impact on profitability as a result of the information, resources, and contacts from the workshops. Over one-third of respondents (36%) indicated that they had created additional jobs for their farm/business/organization. Considering quality-of-life, three-quarters (74%) of respondents reported increased personal satisfaction from their farm and 85% reported increased enjoyment sharing farm life and heritage with visitors.

Key Items of Evaluation

Evaluations from the Vermont Tourism and Recreation Program showed that six to 12 months after workshops, 75% of respondents reported a positive impact on profitability as a result of the information, resources, and contacts from the workshops.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Community Development and the Personal and Intellectual Development of Youth and Adults

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
124	Urban Forestry	9%		0%	
608	Community Resource Planning and Development	3%		0%	
802	Human Development and Family Well-Being	7%		0%	
805	Community Institutions, Health, and Social Services	20%		0%	
806	Youth Development	61%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	5.0	0.0	0.0	0.0
Actual Paid	17.4	0.0	0.0	0.0
Actual Volunteer	15.2	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
578657	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
580427	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2365389	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

4-H Positive Youth Development: programming helps youth acquire Life Skills in the following areas: Decision Making; Critical Thinking; Problem-Solving; Communication; Goal-Setting; and Skills for Everyday Living to succeed as adults. Delivery Methods include 6-8 sequential learning hours using experiential learning techniques for in-school, afterschool, or out-of-school settings

Science, Technology, Engineering, and Math (STEM): programming shows how science and engineering issues affect youths' lives and prepares a future generation of scientists and engineers. The 4-H STEM program presents 4-H with a new opportunity to connect to the LGU's STEM research community and integrate with current youth workforce development initiatives.

Community Leadership: assessing, addressing and expanding community capacity through leadership and public policy education efforts including building--and educating members and clientele of--coalitions and collaboratives.

Coping with Separation and Divorce (COPE): parent education for parents of minor children involved in divorce, establishment of parentage, separation, dissolution of civil unions, and changes in parental rights and responsibilities. This is a court mandated program.

Migrant Education Recruitment Program (MEP): provides educational support services to eligible children and youth who relocate independently or with their families in order to obtain seasonal or temporary employment in agriculture. Delivery Methods: Outreach to schools, agricultural employers, and social service agencies throughout the state.

Vermont Urban and Community Forestry program: a joint initiative between the University of Vermont Extension and the Department of Forests, Parks and Recreation. The mission of the program is to promote the stewardship of the urban and rural landscapes to enhance the quality of life in Vermont communities. The program provides educational, technical and financial assistance in the management of trees and forests, in and around the built landscape as well as First Detector education for invasive pests. Delivery Methods include classes, meetings, various media, and community volunteer projects.

PROSPER [**PRO**moting **S**chool-community-university **P**artnerships to **E**nhance **R**esilience]: a delivery system of evidence-based programs for the purpose of improved Child and Family Outcomes such as long-term reductions in substance use; reduced youth behavior problems; and long-term effects on school engagement and academic success, with similar benefits occurring for both low- and high-risk groups.

2. Brief description of the target audience

4-H Community or Project Clubs Participants (Youth)
4-H Leaders (Adult)
4-H Special Interest or Short-Term Program Participants (Youth)
4-H: Adult Volunteers
4-H: Camp Board Directors
4-H: Youth
4-H: Youth Volunteers
Adults
Age 19 - 24 Young Adult
Age 25 - 60 Adult
Age 6 - 18 Youth

Agriculture: Farm Families
Agriculture: Farmers
Agriculture: Farmers w/disabilities
Agriculture: Government Agency Personnel
Agriculture: Industry Professionals
Agriculture: Livestock producers
Communities: Cities and Towns
Communities: Educators
Communities: Local Officials/Leaders
Communities: Non-Governmental Organizations
Communities: Schools
Community leaders and citizens
Community: Family Court Personnel
Extension: Faculty/Staff
Forestry: Landscape Industry
Forestry: Woodland Managers/Foresters
Funders
Policy Makers: Legislators
Public: Families
Public: General
Public: Migrant In School Youth
Public: Migrant Out of School Youth
Public: Nonprofit Organizations
Public: Parents
Public: Small Business Owners/Entrepreneurs
Public: Volunteers
School Enrichment Program Participants (Youth)
Train-the-Trainer recipients: adults
USDA personnel

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6449	24820	9230	152

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- 4-H Afterschool

Not reporting on this Output for this Annual Report

Output #2

Output Measure

- 4-H Club

Year	Actual
2016	289

Output #3

Output Measure

- 4-H Day Camp

Year	Actual
2016	6

Output #4

Output Measure

- 4-H Overnight camp

Year	Actual
2016	1

Output #5

Output Measure

- 4-H School enrichment

Year	Actual
2016	138

Output #6

Output Measure

- 4-H Short-term/special interest

Year	Actual
2016	133

Output #7

Output Measure

- Class/course

Year	Actual
2016	3

Output #8

Output Measure

- Conference

Year	Actual
2016	6

Output #9

Output Measure

- Consultations

Year	Actual
2016	281

Output #10

Output Measure

- Discussion group

Year	Actual
2016	41

Output #11

Output Measure

- Field site visit

Year	Actual
2016	375

Output #12

Output Measure

- Funding request

Year	Actual
2016	4

Output #13

Output Measure

- Presentations

Year	Actual
2016	33

Output #14

Output Measure

- Publication - fact sheet
  Not reporting on this Output for this Annual Report

Output #15

Output Measure

- Publication - newsletter

Year	Actual
2016	125

Output #16

Output Measure

- Publication - newsprint article
  Not reporting on this Output for this Annual Report

Output #17

Output Measure

- Radio Spots/program (educational
  Not reporting on this Output for this Annual Report

Output #18

Output Measure

- TV segment/ATF

Year	Actual
2016	6

Output #19

Output Measure

- Train the Trainer sessions
  Not reporting on this Output for this Annual Report

Output #20

Output Measure

- Web Page
  Not reporting on this Output for this Annual Report

Output #21

Output Measure

- Workshop - series

Year	Actual
2016	13

Output #22

Output Measure

- Workshop - single session

Year	Actual
2016	53

Output #23

Output Measure

- Trainee delivered programming

Year	Actual
2016	92

Output #24

Output Measure

- Electronic Communication/phone
  Not reporting on this Output for this Annual Report

Output #25

Output Measure

- Mass Media: publications/promotions

Year	Actual
2016	3

Output #26

Output Measure

- Publication - Technical/Article

Year	Actual
2016	10

Output #27

Output Measure

- Curriculum Publication or Update

Year	Actual
2016	5

Output #28

Output Measure

- Display or Exhibit

Year	Actual
2016	31

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	increase in number of farmers with disabilities maintaining employment
2	Number of Migrant Education eligible students enrolled
3	Increase the number of program participants serving as leaders on Committees
4	Number of individuals (youth and volunteers) increasing knowledge and/or skills in content and careers (across subject areas ranging from animal science to environmental science to technology)
5	Number of individuals who use leadership and decision making skills in executing their role and responsibilities effectively developing and/or implementing policy
6	Increase the number of parents understanding family transition through parentage, divorce or separation who understand the impact of these changes on their children.
7	increase in number of youth reached with positive youth development programming demonstrate mastery for targeted life skills, including: Decision making; wise use of resources; communication; accepting differences; leadership; useful/marketable skills; healthy lifestyle choices; and/or self-responsibility
8	Number of volunteers and staff demonstrating new techniques/activities in clubs and programs learned through 4-H training and developmemnt
9	Number of individuals who use skills and effectively participate in addressing community issue(s) (e.g. green infrastructure, local leadership, hunger, volunteerism, etc.)
10	Number of participants who are English language learners will increase their level of English proficiency
11	The number of communities or community group/organization(s) establishing or expanding projects to improve or mitigate a community issue

Outcome #1

1. Outcome Measures

increase in number of farmers with disabilities maintaining employment

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of Migrant Education eligible students enrolled

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	294

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
805	Community Institutions, Health, and Social Services

Outcome #3

1. Outcome Measures

Increase the number of program participants serving as leaders on Committees

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of individuals (youth and volunteers) increasing knowledge and/or skills in content and careers (across subject areas ranging from animal science to environmental science to technology)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1154

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
American youth are losing ground in science, technology, engineering, and math (STEM) compared to peers in other nations. Although the United States is currently the world's economic and military leader, too many young Americans do not have the STEM career skills necessary to succeed and meet our country's needs in the future.

What has been done
UVM Extension 4-H programs are built on the premise that children learn best through hands-on activities. These experiences can help young people build a foundation in STEM, ultimately preparing them for the science and technology oriented world of work. 4-H delivered 196 STEM-focused programs this year, directly reaching youth 3,375 times through 4-H TRY for the Environment, the 4-H Tri-State Agriculture Tour, and 4-H Tech Wizards, to name a few.

Results
Participating youth indicated an increase in STEM-related knowledge 1,154 times because of their involvement in 4-H programming. Other significant impacts include: 75 teenagers volunteered 1,500 hours of their time to teach 728 students about renewable energy, waste management, and food systems through the TRY for the Environment program; the 4-H Tri-State

Agriculture Tour led 97% of participating youth to share a new belief that science will be an importance part of their future; and students in the 4-H Tech Wizards program improved skills in critical thinking, data collection, and data interpretation. Today's youth are tomorrow's leaders and problem-solvers. Developing and learning to use life skills prepares them for success in STEM fields and beyond.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

Number of individuals who use leadership and decision making skills in executing their role and responsibilities effectively developing and/or implementing policy

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Increase the number of parents understanding family transition through parentage, divorce or separation who understand the impact of these changes on their children.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1233

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being

Outcome #7

1. Outcome Measures

increase in number of youth reached with positive youth development programming demonstrate mastery for targeted life skills, including: Decision making; wise use of resources; communication; accepting differences; leadership; useful/marketable skills; healthy lifestyle choices; and/or self-responsibility

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	839

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to "Advance Vermont," a group of Vermont stakeholders addressing workforce needs, "twenty-six percent of Vermont's Class of 2012 high school graduates had aspirations to go to college but did not do so." Fortune 500 Companies report that the top five skills they look for are teamwork, problem-solving, interpersonal, communication, and the ability to listen. Youth need to learn these soft skills and to have caring adults that can nurture and encourage them to move into post-secondary education in order to build the workforce our country needs.

What has been done
Participation in UVM Extension 4-H builds both life and job skills. By enabling youth to choose areas of their interest to explore, in partnership with adults that can support and nurture, they are better able to connect and build on learning that supports their future. This year, 333 4-H activities, including club programming, "TRY for the Environment," "VT Youth Agriculture IDA Program" and more, made direct contact with youth 5830 times. That 4-H involvement led to the mastery of life skills for 839 4-H members.

Results
After querying 4-H club members that graduated high school in the Spring of 2016, it is clear that longer-term involvement in 4-H clubs makes a difference in future direction. Of those respondents, ninety percent believe that their 4-H involvement helped them get into college. And of those responding to the open-ended question, 75% indicated that 4-H activities helped them to develop their interests for a future career. In addition to college plans, 4-H also builds the skills

that employers are desiring. Of those responding to the 4-H workforce survey, 92% indicated that they always think everyone on their team is important and 92% always respect differences and strengths of their team members. With these skills and direction, 4-H members are likely to have a positive impact on the future of Vermont's workforce and economy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #8

1. Outcome Measures

Number of volunteers and staff demonstrating new techniques/activities in clubs and programs learned through 4-H training and developmemnt

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	117

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
806	Youth Development

Outcome #9

1. Outcome Measures

Number of individuals who use skills and effectively participate in addressing community issue(s) (e.g. green infrastructure, local leadership, hunger, volunteerism, etc.)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	253

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Vermont communities are faced with environmental, social and financial consequences of our changing climate. Climate action and alternative energy decisions can be complex and divisive at the community level. Education and technical assistance are needed for communities looking to decrease their carbon footprint, use energy more efficiently, find acceptable solutions to siting renewable energy facilities, and build citizen capacity to negotiate the complexities of creating an energy plan.

What has been done
To encourage citizens to increase their understanding of local-level opportunities for addressing energy and climate change, UVM Extension and the Vermont Energy and Climate Action Network co-hosted the 9th Annual Community Energy and Climate Action conference. 245 people from 12 Vermont counties and three states participated. Attendees included community energy committee members and volunteers interested in raising awareness of climate change, reducing energy usage, and increasing the understanding and use of alternative energy resources.

Results
In June 2016, a follow-up survey was sent to all participants of the conference. Seventy-three percent of respondents (representing 11 counties) indicated that their community had started at least one new project related to energy efficiency and/or alternative energy since attending the conference. The most common projects undertaken include: applying for funding for a project, holding a town energy event to increase education and awareness, and conducting energy audits of town buildings. Additional communities reported the completion of longer-term projects, including the installation of alternative energy systems. Together, an estimated 210 people used their acquired skills to participate in energy- and climate-related community change.

4. Associated Knowledge Areas

KA Code	Knowledge Area
124	Urban Forestry
608	Community Resource Planning and Development
802	Human Development and Family Well-Being
806	Youth Development

Outcome #10

1. Outcome Measures

Number of participants who are English language learners will increase their level of English proficiency

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	119

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Latino migrant farmworkers in Vermont have limited access to English language instruction, community services, and social interaction. Providers of adult education and literacy services and other social services have difficulty reaching this population.

What has been done
The Migrant Education Program collaborated with Vermont Adult Learning and Franklin/Grand Isle Community Action to provide two 40-hour beginning and intermediate level English classes. Our staff recruited participants and provided transportation, materials, and early education services for Migrant Education Program students and families. An additional English language course was held in Craftsbury, Vermont as well as statewide outreach and education during the summer.

Results
As a result of these classes, farmworkers gained confidence using English, became familiar with social services available to them in their community, and had the opportunity to connect with their colleagues working on other farms. All 119 students reported an increase in their English language proficiency because of their participation in MEP programs. Vermont Adult Learning,

having seen the numbers of potential English language students in Franklin County, is now considering funding a permanent English language instructor for their St. Albans learning center.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
805	Community Institutions, Health, and Social Services

Outcome #11

1. Outcome Measures

The number of communities or community group/organization(s) establishing or expanding projects to improve or mitigate a community issue

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	40

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
124	Urban Forestry
608	Community Resource Planning and Development
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Transportation is often an issue for rural youth to participate in out of school-hours programming.

Youth Financial Literacy is not a required curriculum in VT public schools and is required in less than 10 states in the U. S.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Annual Community Energy and Climate Action Conference evaluation: In June 2016 a follow-up survey was sent to all participants of the conference. The survey was sent by email and there were three reminders sent. We received 62 responses (25% of the total conference participation) from eleven counties.

72.6% of respondents indicated that their community had started at least one new project related to energy efficiency and/or alternative energy since attending the conference. The most common projects undertaken by communities represented at this conference included:

- Applying for funding for a project (63%)
- Holding a town energy event to increase education and awareness (52%)
- Conducting energy audits of town buildings (30%)
- Revitalizing and/or expanding the town energy committee (29%)
- Revising the community energy plan (22%)
-

[Note: respondents were encouraged to select multiple activities]

The planning committee was also interested in what longer term projects had been completed because of participation in past conferences. The list of those projects included the following:

- Conducted energy audits on public buildings (67%)
- Installed an alternative energy system (e.g. solar, hydro, wind, geothermal) (57%)
- Secured grant funding to support our work (38%)
- Measured the savings from energy efficiency modifications (33%)

- Initiated a community-wide campaign to increase the purchase of locally-produced food (14%)

[Note: respondents were encouraged to select more than one option]

Key Items of Evaluation

The Annual Community and Climate Action Conference evaluation concluded that 72.6% of respondents' communities had started at least one new project related to energy efficiency and/or alternative energy since attending the conference.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		33%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		2%	
205	Plant Management Systems	0%		18%	
206	Basic Plant Biology	0%		5%	
601	Economics of Agricultural Production and Farm Management	0%		29%	
605	Natural Resource and Environmental Economics	0%		13%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.6	0.0
Actual Paid	0.0	0.0	2.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	183786	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	108961	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	8569	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Feasibility studies on the use of methane digesters to convert cow manure into electricity
- Development of biofuels through plant-based energy products

2. Brief description of the target audience

- Adults
- Agriculture: Crop Producers
- Agriculture: Dairy Farmers
- Plant biology community.
- Community members
- Researchers
- Policymakers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Workshop - single session

Year	Actual
2016	1

Output #2

Output Measure

- Research projects

Year	Actual
2016	3

Output #3

Output Measure

- Research poster(s)

Year	Actual
2016	1

Output #4

Output Measure

- Presentations

Year	Actual
2016	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of individuals who implement recommended practice(s) beginning energy crop production or increasing yield and/or quality of existing crops contributing to a sustainable, cost effective energy source
2	Number of research findings important in the structure of the plant cell wall during growth that will aid in the usage of using cell walls as a source of biofuels.
3	Number of research studies that access the financial and economic feasibility of converting cow manure into renewable energy products.

Outcome #1

1. Outcome Measures

Number of individuals who implement recommended practice(s) beginning energy crop production or increasing yield and/or quality of existing crops contributing to a sustainable, cost effective energy source

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of research findings important in the structure of the plant cell wall during growth that will aid in the usage of using cell walls as a source of biofuels.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Plant cell walls represent a renewable source of carbon for the development of biofuels and other plant based energy products. Cell walls are structures whose composition changes in response to changes in the environment. It is important to understand cellular pathways that regulate cell wall structure to provide critical information necessary for an energy-efficient, selective breakdown of plant cell walls in the development of biofuel products in the future.

What has been done
Experiments were performed to further explore the function of VTI13, a SNARE that is regulated by cell wall structure and whose function is essential for cell wall metabolism.

Results
VTI13 was characterized and genetic analysis used to show that its function is required for root hair grow. The results show that VTI13 plays a unique role in endosomal trafficking pathways associated with the vacuole within the root hairs and is essential for the maintenance of cell wall organization and root hair growth in arabidopsis.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms

Outcome #3

1. Outcome Measures

Number of research studies that access the financial and economic feasibility of converting cow manure into renewable energy products.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Anaerobic digester systems (ADS) benefit Vermont dairy farms, reduce agricultural runoff, and help meet renewable energy goals. As a result of increasing production costs, fluctuating milk prices, and more strict regulations imposed on manure management, more than 250 American farms have installed these systems in an effort to diversity income and comply with regulations. As a dairy state with 18 installed digesters, Vermont has been a leader in the development of these on-farm systems and provides a unique environment for studying ADS feasibility.

What has been done
The research team collected primary data and analyzed the investment, energy outputs, as well as operational costs, revenue and return on investment.

Results
The findings point to a growing need for more information on the economic feasibility of ADS for small- and medium-sized dairy farms. Smaller operations in Vermont usually have between 75 and 500 cows. 95% of dairy operations in Vermont have fewer than 500 cows. It is very challenging for farms of this size to achieve positive financial returns operating an ADS.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management

605 Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Government Regulations

Brief Explanation

Small- and medium-sized dairy farms research indicates that the costs of purchasing on-farm digesters would be very challenging. Community-based systems developed in Europe and in China may be helpful in evaluating optimal locations for community ADS that may be used by multiple dairy farms in Vermont.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Anaerobic digestors treat animal manure. If all farms in the U.S. used anaerobic digestors, it would supply 1.8-3% of this country's annual electricity. AES research collected data from Vermont dairy farms with operating biodigester systems and conducted economic and financial analyses.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Childhood Obesity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
604	Marketing and Distribution Practices	14%		0%	
607	Consumer Economics	14%		0%	
703	Nutrition Education and Behavior	6%		34%	
704	Nutrition and Hunger in the Population	36%		0%	
724	Healthy Lifestyle	9%		49%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%		4%	
805	Community Institutions and Social Services	21%		0%	
903	Communication, Education, and Information Delivery	0%		13%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.2	0.0	3.0	0.0
Actual Paid	6.6	0.0	3.0	0.0
Actual Volunteer	0.4	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
218119	0	178864	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
218786	0	290857	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
891611	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Enhancing Healthy Food Access: This work is designed to directly or indirectly enhance access to healthy, affordable food by households or organizations (e.g. schools), many of which are managing on tight food budgets. Methods include 1) assessment of barriers to food security in the household; 2) education on topics related to the dietary guidelines and food management strategies; 3) distribution of coupons to purchase produce, or distribution of the produce itself; and 4) demonstration of food preparation techniques along with taste-testing opportunities. In-depth analysis of program effectiveness and production of manuscripts on research topics are also part of this work.

Projects Include: Enhancing Food Security in the Northeast; Senior Farm Share; Measuring Food Security among Vermont Resettled Refugees; Northeast Kingdom Produce Coupon Program; VT Dept. of Health Produce Prescription Project; Farm to School.

Bridges to Health/Puentes a la Salud: Bridges to Health is a health outreach program for migrant farmworkers in Vermont. Utilizing a care coordination model carried out by regional Migrant Health Promoters, the program empowers farmworkers to make timely health decisions. In addition to offering care coordination to migrant farmworkers in need of health care services, Bridges to Health creates capacity building opportunities for local health entities to implement linguistically and culturally appropriate services.

Farm to Plate: a network that unifies business, government and non-profits to scale up local food production and consumption. Network of more than 160 organizations working to achieve goals to re-localize food production and distribution.

USDA National School Lunch Program: implements regulations requiring children to select a fruit or vegetable (FV) with their lunch meal. Research is developing a web-based training tool to train school-based staff in digital imaging as a way to access children's consumption of fruit or vegetable based upon providing fresh and local produce to schools.

Additional Research:
Research studies examine communication exchanges that contribute to the dietary beliefs, attitudes, or behaviors of attending dieticians and sponsors and how these health messages are shared with the public.

Research studies examine whether crowdsourcing can generate novel ideas to further insight into what men think about weight and weight loss. A curriculum has been developed and men have been recruited

for further evaluations.

2. Brief description of the target audience

Age 19-24 youth
Age 6 - 12 School Age
Age 60 - Senior
Agriculture: Beginning Farmers
Agriculture: Migrant workers
College and Highschool Students
Communities: Non-Governmental Organizations
Community: Health Entities
Culinary Instructors
Dieticians
Nutrition Educators
Public: Families with Limited Resources
Public: Health Providers
Public: Small Business Owners/Entrepreneurs
Scholarly audiences related to healthcare

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	998	0	0	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	4	4

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Consultation

Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Consumer Publication

Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Curriculum

Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Fact Sheets

Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Publication - Newprint

Year	Actual
2016	6

Output #6

Output Measure

- Train the trainer program

Not reporting on this Output for this Annual Report

Output #7

Output Measure

- Workshop Series

Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Workshop - single session

Year	Actual
2016	15

Output #9

Output Measure

- Webpage (new and updated)

Year	Actual
2016	1

Output #10

Output Measure

- Presentation

Year	Actual
2016	5

Output #11

Output Measure

- Research projects

Year	Actual
2016	14

Output #12

Output Measure

- Education - class/course

Year	Actual
2016	43

Output #13

Output Measure

- Education - field site visit

Year	Actual
2016	19

Output #14

Output Measure

- Publication - evaluation instrument

Year	Actual
2016	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of individuals who incorporate one or more healthful eating practices and/or physical activity to prevent/manage disease and/or obesity
2	Number of individuals who use food planning and wise shopping behaviors to improve diet and the supply of food
3	The number of individuals who select and prepare a variety of produce to help prevent/manage disease and/or obesity
4	Number of research studies that incorporates technology as a way to self-monitor food intake and physical activity to improve diet and health.
5	The number of individuals who take steps to meet daily needs for health, education, social and personal wellbeing

Outcome #1

1. Outcome Measures

Number of individuals who incorporate one or more healthful eating practices and/or physical activity to prevent/manage disease and/or obesity

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of individuals who use food planning and wise shopping behaviors to improve diet and the supply of food

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	40

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
607	Consumer Economics
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population

Outcome #3

1. Outcome Measures

The number of individuals who select and prepare a variety of produce to help prevent/manage disease and/or obesity

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	417

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Inadequate intake of fruits and vegetables is rampant in households across the U.S. For some communities, the problem starts with a lack of availability of a variety of fresh produce in local markets. The 2015 Dietary Guidelines for Americans indicate that most people need to increase their consumption of vegetables (including all five of the vegetable subgroups), as well as fruits, especially whole fruits. Adequate consumption of produce is associated with decreased risk of a number of chronic diseases.

What has been done
To address this problem, the USDA recently initiated FINI grants which support communities across the country in their efforts to initiate programs that increase access to produce for Supplemental Nutrition Assistance Program (SNAP) recipients. In Vermont, 417 households (including 815 people) in the Northeast Kingdom received $75 worth of vouchers per household that could be used at participating local grocery stores exclusively for the purchase of fruits and vegetables.

Results
Over the course of the six-month program, nearly 95% of vouchers were redeemed. Participants were excited about the program and provided positive feedback about their experiences: "I feel blessed to be able to eat the fruits and vegetables I enjoy but wouldn't be able to afford"; "This helped me teach my 9-year-old about new foods"; "I was able to have vegetables through most of my pregnancy." We are continuing to assess the direct influence this program had on the amount of produce consumed by SNAP recipients, and look forward to continuing the program in the coming year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

Outcome #4

1. Outcome Measures

Number of research studies that incorporates technology as a way to self-monitor food intake and physical activity to improve diet and health.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Diet and a physically active lifestyle are important for weight control and optimal health. Previously it has been difficult to incentivize physical activity and monitor food intake. Technology will help to do this. The studies will contribute to a better understanding of the role that technologies can play in helping individuals self-monitor their diet and health.

What has been done
Students were involved in the planning for age appropriate technology to ensure desired program impact and sustainability. Pilot studies were done and preliminary data on the usability of technology was done.

Results
As a result of the studies, YPAR was used to develop Camp Conquer, a game designed to incentivize physical activity in high school students. The other study looked at the MyEnergyBalance iPhone app and website as a tool for diet analysis. Results from that study have shown that there is significant correlations between subjects' usability scores and relative accuracy of the subjects' food recall using the images from the iPhone app.

4. Associated Knowledge Areas

KA Code	Knowledge Area

703	Nutrition Education and Behavior
724	Healthy Lifestyle
903	Communication, Education, and Information Delivery

Outcome #5

1. Outcome Measures

The number of individuals who take steps to meet daily needs for health, education, social and personal wellbeing

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	257

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Vermont's Latino dairy workers and their families are geographically and linguistically isolated. Our migrant workers are crucial to Vermont's dairy economy, yet because of this isolation, they struggle to access important public services like healthcare and have challenges consistently accessing the fresh vegetables and herbs they want.

What has been done
The Bridges to Health (BTH) program provides farmworkers and their families access to healthcare services as well as culturally familiar and local foods. This year, BTH coordinated 19 on-farm healthcare visits allowing farmworkers to receive wellness checks and consult on ongoing health issues. Education and support also helped 125 migrant workers to cultivate 43 kitchen gardens.

Results
Because of the outreach provided by Bridges to Health, 250 farmworkers and their family members sought support to promote their personal and familial health. They accessed health care services, attended health related classes, and participated in the kitchen garden project. These and other opportunities provided by Bridges to Health help fill the critical gaps in health care and access to food for some of Vermont's most vulnerable residents.

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices
607	Consumer Economics
704	Nutrition and Hunger in the Population
805	Community Institutions and Social Services

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

The 2014 Food and Nutrition Conference and Expo hosted by the Academy of Nutrition and Dietetics found that dietitians found it difficult to discern between informational and persuasive messages when talking to food industry representatives.

USDA National School Lunch Program implemented regulation requiring children to select a fruit or vegetable with their school lunch.

Vermont School Food Service operations vary considerably in size and sophistication. Production methods vary from "conventional' where ingredients are purchased fresh and products are made from scratch to "assembly" where products are purchased already prepared. The physical plants range from full-service commercial kitchens to very small kitchens that might lack commercial dishwashers, hand washing sinks, adequate storage areas, or commercial ovens. The educational level of staff ranges from college-level to less than grade 8. Turnover is high amongst employees.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

SNAP Outreach Efforts included research conducted to assess the program's effectiveness of improving SNAP recipient diets. Three hundred and thirty-one people participated in the program. Out of that number, 73 were reached via phone for assessment of impact. 55% (n=40) noted improvement in food security and 35 people indicated at least one postive dietary change.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Food Safety

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		9%	
215	Biological Control of Pests Affecting Plants	0%		9%	
308	Improved Animal Products (Before Harvest)	0%		6%	
311	Animal Diseases	0%		10%	
503	Quality Maintenance in Storing and Marketing Food Products	0%		17%	
604	Marketing and Distribution Practices	0%		3%	
607	Consumer Economics	0%		3%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%		8%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%		31%	
722	Zoonotic Diseases and Parasites Affecting Humans	0%		4%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.2	0.0	5.0	0.0
Actual Paid	0.0	0.0	7.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	88567	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	477291	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	220030	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Vermont leads the nation in direct sales of local and specialty food production on a per capita basis. Ensuring the safety of locally produced and processed food products is critical to protecting the state's reputation and markets.

Research is being done to develop methods to detect and evaluate the potential for growth and survival of pathogens of concern to Vermont artisan cheese makers. Development and application of novel tools advance the understanding of innate and adaptive immunity and disease resistance in cattle. Cultural and biological controls are being done to suppress anthropod pests. Proteins are added to milk to enrich health-promoting bioactive fatty acids.

Value-added (functional) foods - Enrichment/addition of ingredients or modification to milk can provide benefits beyond traditional value. Milk and dairy products constitute one of the most important types of value-added products.

Cultural and biological control in Pest Management- Use of entomopathogens in biological arthropod pest suppression in cropping systems.

2. Brief description of the target audience

- Adults
- Public: General
- Small-scale meat and produce farmers
- Artisan cheese makers and consumers
- Researchers
- Small food processors
- Dairy farmers
- Industry partners
- Regulatory officials
- Pest managers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	17	17

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Newsprint Article

Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Research projects

Year	Actual
2016	4

Output #3

Output Measure

- Workshops
  Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Social media/blog posts/webpage updates
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Presentations

Year	Actual
2016	20

Output #6

Output Measure

- Conferences

Year	Actual
2016	10

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of producer/processors who show improvement in food safety and preservation practices
2	Number of practices that help cheese farmers alleviate the presence of pathogens in artisan cheese production facilities.
3	Number of research results that educate cheesemakers with valuable information about crystals that formulate on artisan cheeses which impact the cheese quality.

Outcome #1

1. Outcome Measures

Number of producer/processors who show improvement in food safety and preservation practices

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of practices that help cheese farmers alleviate the presence of pathogens in artisan cheese production facilities.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Artisanal cheese making has become a vibrant and highly visible component of the Vermont dairy industry. Artisanal cheese must command premium prices in the marketplace in order to be economically sustainable and therefore, must be readily differentiated from lower cost conventional cheese through quality attributes that render them more interesting and satisfying.

What has been done
391 samples were tested between January 2016 and May 2016.

Results
Filter testing, end product and environmental testing should be employed in the safety plan of raw milk artisan cheesemakers. Silage feeding should be eliminated from animal husbandry practices if the milk produced is destined for artisan raw milk cheese. Farms should encourage pasture feeding when possible as it reduces the instance of L monocytogens (pathogen) in the barn. Water bowls and areas that are constantly wet should be monitored and have an established cleaning protocol. Waste drains should not be allowed to drain on the floor, but should be directly connected to a floor drain to minimize water presence on the milk house floor. Flow of traffic within the barn should be organized so that high traffic areas are minimized and are well

managed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #3

1. Outcome Measures

Number of research results that educate cheesemakers with valuable information about crystals that formulate on artisan cheeses which impact the cheese quality.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Artisanal cheese making has become a vibrant and highly visible component of the Vermont dairy industry. Artisanal cheese must command premium prices in the marketplace in order to be economically sustainable, therefore, they must be readily differentiated from lower cost conventional cheese through quality attributes that render them more interesting and satisfying.

What has been done
Reseach focused on crystals that form at the surface of soft bloomy rind cheese.

Results
Research determined that the crystals that form on the surface of bloomy rind cheese consist of calcium phosphate. There is a link that this crystallization adds to the characteristic internal softening of this cheese during ripening. Two crystals, ikaite and struvite, were identified on the surfaces of washed rind cheeses. Ikaite and struvite are likely associated with gritty mouthfeel and research has constructed a 3-dimensional molecular structure of ikaite and struvite. This

information was used to develop an inexpensive and simple presumptive test to identify ikaite and struvite on washed rind cheese using polarized light microscopy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Other (Food safety requirements of food)

Brief Explanation

Consumer interest in artisan and farmstead cheeses is driving explosive growth of on-farm cheese operations throughout the United States. As many of these enterprises are small to very small establishments, there is a need for focus on assuring microbiological safety of cheese produced on the farm. In 2010, U.S. Food and Drug Administration intensified its scrutiny of U.S. cheese makers. In particular, increased regulatory attention focused on small-scale artisan cheese makers and those producing cheese from raw milk.

The new U.S. Food and Drug Administration regulation could limit production of raw milk cheeses. In 2015 the FDA reduced the allowable measure of non-toxigenic E. coli in raw milk cheese from 10,000 per gram to new MPN (Most Probable Number) standard of 10 per gram. The mpm-toxigenic E. coli are a part of the natural microbial process that is in the making of classic raw milk cheeses.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

With the implementation of the Food Safety Modernization Act of 2011, the Hazard Analysis and Critical Control Point requirements for food safety plans became a regulatory requirement. The changes have had an important impact on small and artisanal cheesemakers.

Food safety pathogen epidemiology and detection research are addressed across the entire on-farm cheese production chain. Integration of detection technologies and an improved understanding of pathogen epidemiology mitigate food safety risk on dairy farms producing cheese or other raw milk products.

Key Items of Evaluation

Consumer interest in artisan and farmstead cheese is driving explosive growth of on-farm cheese operations throughout the United States and in Vermont. Many of Vermont

enterprises are small to very small establishments. Researchers are addressing the need to focus on assuring the microbiological safety of cheeses produced on the farm. With 38 artisan cheese producers, Vermont boasts the highest number of artisan cheese makers per capita in the United States. In order to allow this industry to grow and prosper, it is essential that the safety of artisan cheese be assured.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
0	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
0	Number of new crop varieties, animal breeds, and genotypes whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
2433	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
0	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
0	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
0	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.