2017 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.

As we approach the second year of the reintegration of EXT into CALS, we focus our efforts on the following crucial areas: agriculture and food systems, environment, nutrition and health, and human and community development. Through multidisciplinary work and integration of research and outreach, these areas 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 Food 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 water quality improvement, to cost of health insurance and childcare, to future U.S. agricultural production, to 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 hundreds of millions of dollars to the Vermont economy. Research and outreach provide support through workshops, site visits and electronic communications to assist the Vermont community with best management practices.

With the Vermont dairy industry declining from 3,372 farms in 1980 to 868 farms in 2014, (http://www.vermontdairy.com/learn/number-of-farms/) CALS outreach and research efforts are increasingly important. We help solve some of the most pressing issues surrounding 21st Century farming, food systems that work, and building Vermont communities. This year we delivered over 2,000 educational activities related to Global Food including consultations, workshops and presentations to more than 8,150 direct points of contacts. These efforts resulted in the implementation of 1,092 recommended business practices. For example, the UVM Grain Research and Outreach conferences helped 71 farmers make changes like testing grains, improving drying facilities and adding new crop rotations. Vermont Open Farm Week, an event co-led by EXT, helped 97% of participating farms experience benefits such as increased profits and new customers. Improvements like these increase business profitability and better secure the financial future of agriculture in Vermont.

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 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. It can also include the development and application of good agricultural practices, like the Community Accreditation for Produce Safety (CAPS) program promotes. This year CAPS enabled 91 farms to create produce safety plans, representing aggregate sales of fresh produce valued at $20.6 million.

Our Food Safety Program conducts research, disseminates information and provides consultations to improve the safety of food in and around the state. Vermont has the highest number of producers of artisan cheese per capita in the United States and in order for this industry to grow and prosper, it is extremely important to ensure best food safety practices. EXT's Food Safety Specialist delivered 14 classes and workshops to 330 participants this year to address these and other food safety issues. This training and assistance resulted in a local sauce making facility passing a food safety audit, enabling sales to a large retailer; a local restaurant can now sell dry meat because their curing process passed inspection; and a cheese maker is updating their food safety plan and starting an environmental control program based on ATP (adenosine triphosphate) sanitation testing.

Two-thirds of Americans are overweight, 48 million are falling ill to pathogens, and there is an ongoing threat of food insecurity. In response, CALS developed a food systems program and is collaborating at university, state, and national levels to develop and maintain it. The program embraces environment, production systems, business development, health, and nutrition by integrating food systems and food culture.

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. This increases their knowledge and skills and encourages implementation of cost-effective, environmentally sound sustainable agricultural practices. These researchers are known both nationally and internationally for their contributions by way of publications through educational programs, laboratory instruction, workshops, and outreach.

We take pride in our stewardship of the environment and natural landscape through ongoing efforts to improve water quality in Lake Champlain and other watersheds. Our Nutrient Management Program (NMP) is just one example of CALS' effort to address this critical issue. NMP conducted 232 educational activities this year and assisted 7,803 farmers and landowners with the implementation of practices to improve farm profitability and water quality protection. Because of this education and guidance, farmers adopted 184 best management practices and positively affected Vermont's cropland, its associated livestock production facilities, and water quality.

Investing in Vermont's future begins with some of our most valuable citizens: children and youth. This year 815 youth demonstrated mastery of a transferable skill like decision-making, communication or leadership because of their participation in our 4-H Youth Development Program. Students who participate in 4-H are developing life and job skills - also known as transferable skills - that complement the classroom and prepare them for post-secondary education. Of the 127 Vermont students who graduated from high school between 2015 and 2017 and participated in 4-H clubs, 66% went on to college compared to the state's 53%. 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 show the breadth and depth of CALS 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, the CALS mission of research-based service and educational outreach continues to focus

on contemporary problems, needs and challenges of a changing state and world.

Follow this link to see a copy of our Annual Report 2017:

https://www.uvm.edu/sites/default/files/UVM-Extension-Cultivating-Healthy-Communities/annualreport2017.pdf

Total Actual Amount of professional FTEs/SYs for this State

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	55.0	0.0	28.0	0.0
Actual	70.2	0.0	59.0	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

EXT 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.

EXT 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 other research endeavors.

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, research, 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 EXT 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 EXT 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.

EXT recently initiated a visioning process to help the organization articulate its future in a new Strategic Plan. We are engaging and gathering input from all parts of the organization as well as from external partners. We are exploring what EXT has been, what it is today and what we would like it to be five years from now. We are also reflecting on how the ongoing reunification with CALS may influence our programmatic directions. The final plan will clarify our purpose and mission, identify potential paths forward that will improve financial security, be inspirational to its faculty and staff, and bring greater value to UVM, Vermonters, and various stakeholders in Vermont and beyond.

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 EXT and Dean of CALS (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 Agency of Agriculture, Food, and Markets, Vermont Association of Conservation Districts, USDA Rural Development, USDA Farm Service Agency, representatives from all three Congressional offices, and other organizations as available or interested.

EXT's strategic planning process called for a hired facilitator to interview 45 people as part of an information collecting process. These people included faculty and staff who work in Extension; individuals who work at UVM but who are not part of Extension; and stakeholders who are external to UVM. The Strategic Planning process is being led by a Core Group of EXT and CALS faculty and staff. This Core Group considered many names for the 45 interviews, including those recommended by faculty and staff from EXT.

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 CALS/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, research, finance, marketing, to name a few. New research initiatives are discussed during that meeting. The board reviews the College Strategic Plan and provides information on future trends of agriculture and life sciences. Information regarding the board can be found at https://www.uvm.edu/cals/board_advisors_0.

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.

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

Through EXT's Strategic Planning process, 45 face to face and/or phone interviews were conducted with faculty and staff, individuals who work at UVM but who are not part of EXT, and stakeholders who are external to UVM. The Core Group of the planning process invited larger EXT participation and input by holding a webinar and will soon conduct a day-long workshop to review and provide input on a rolling draft of the Strategic Plan.

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. EXT has close relationships with state and local government, an asset when seeking input and when sharing expertise and/or concerns of citizens.

EXT's Strategic Planning process thus far has led to the creation of a rolling draft of common themes and strategic questions for consideration. All conversations, comments, thoughts, and questions collected will be used to create a Strategic Plan for EXT. The final plan will clarify our purpose and mission, identify potential paths forward that will improve financial security, be inspirational to faculty and staff, and bring greater value to UVM, Vermonters, and various stakeholders in Vermont and beyond.

The AES advisory board provides a source of council to the Dean/Director, using member input to help formulate a research direction and aid in the development of a strategic plan.

Brief Explanation of what you learned from your Stakeholders

Over the last year, EXT advisory board members shared their knowledge and viewpoints on working through some major changes that have faced EXT. Two such changes were a new leadership structure for EXT along with our reintegration into CALS. The board encouraged being open to change and how to best leverage combined resources, increase outreach opportunities and build on our unique strengths. Meeting discussions also centered on strategic planning goals, mission focus and prioritizing key issues important to the state. Some topics addressed by the group involved increased access to local foods and food systems groundwork, responsible land stewardship for improving water quality and continuing to promote youth leadership skills and decision making. Members also assist with board recruitment and serve as ambassadors in their respective towns to facilitate community engagement and encourage partnerships with the university and area agencies and organizations who also work towards similar goals of cultivating healthy communities.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{No Data Entered}	{No Data Entered}	{No Data Entered}	{No Data Entered}

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	1897750	0	13373275	0
Actual Matching	1950429	0	2779450	0
Actual All Other	8167581	0	2055423	0
Total Actual Expended	12015760	0	18208148	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

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
112	Watershed Protection and Management	2%		0%	
123	Management and Sustainability of Forest Resources	2%		0%	
133	Pollution Prevention and Mitigation	35%		0%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		5%	
205	Plant Management Systems	3%		9%	
206	Basic Plant Biology	0%		14%	
212	Diseases and Nematodes Affecting Plants	0%		6%	
216	Integrated Pest Management Systems	3%		7%	
305	Animal Physiological Processes	0%		8%	
308	Improved Animal Products (Before Harvest)	0%		8%	
311	Animal Diseases	0%		9%	
312	External Parasites and Pests of Animals	0%		3%	
315	Animal Welfare/Well-Being and Protection	0%		8%	
402	Engineering Systems and Equipment	6%		0%	
601	Economics of Agricultural Production and Farm Management	31%		8%	
602	Business Management, Finance, and Taxation	10%		0%	
605	Natural Resource and Environmental Economics	4%		1%	
609	Economic Theory and Methods	0%		7%	
723	Hazards to Human Health and Safety	4%		2%	
802	Human Development and Family Well-Being	0%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	29.9	0.0	15.0	0.0
Actual Paid	38.7	0.0	28.0	0.0
Actual Volunteer	2.0	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**
1046158	0	12582740	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1075198	0	1370039	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
4502480	0	472217	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

UVM Extension project listed in bold followed by delivery methods:
Agricultural 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.
Farming Alternatives. Workshops, consultations, farm visits.
Food Safety. Articles, workshops, consultations.
Forage and Pasture Management Education. Presentations, farm visits, consultations.
GAP (Good Agricultural Practices). Consultations, workshops, manual publication, research.
Ground Work: Building Capacity to Provide Tractor Education. Curriculum, workshop, evaluation.
Livestock Production and Products. Class, consultations, research.
Maple Program. Conference, workshops, newsletter.
Nutrient Management Program. Farm visits, consultations, classes.
Organic Grain Project. Demonstrations, data gathering.
Pest Management Education. IPM and Pesticide Education and Safety Program (PESP) training
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, workshops.
Women's Agricultural Network. Newsletters, website, classes, workshops, individual and small group consultations.

AES Efforts:

- **Animal Manure Treatment Systems**
- **Storm and Wastewater Management Systems**
- **Perturbation of soil ecosystems by anthropomorphic interventions**
- **Soil nutrient effect on forest ecosystem productivity and lake water quality**
- **Soil fertility/chemistry/physical problems associated with waste disposal and bioremod faction**
- **Economics of organic dairy, crop management and alternative energy**
- **Heifer nutrition, rearing and management**
- **Dairy nutritional immunology**
- **Small ruminant production and management systems**
- **Development of strategies to address applied equine issues**
- **Biofuels from coconuts and other energy sources**
- **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**
- **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**

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: Certified Crop Advisors & 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
Communities: Cities and Towns
Communities: Educators
Communities: Local Officials/Leaders
Communities: Non-Governmental Organizations
Communities: Town Health Officers
Community: Government
Community: Health Entities
Environmental Professionals: Environmental Managers
Food Industry: Food Service Workers
Food Industry: Handlers
Food Industry: Processors
Food Industry: Producers
Forestry: Government Agency Personnel
Forestry: Landscape Industry
Forestry: Loggers
Forestry: Wood Products Businesses
Forestry: Woodland Managers/Foresters
Forestry: Woodland Owners
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
Public: Youth
Train-the-Trainer recipients: adults
USDA personnel
STEM students

Ecologists
Evolutionary biologists

3. How was eXtension used?

An Organic Dairy Website was developed as part of the eXtension eOrganic project.

eXtension Farm Energy Website: A resource base of 170+ peer reviewed articles, fact sheets, webinars, videos, ask-an-expert specialists, enterprise budgets, decision making tools, etc., from CenUSA are now available to assist bioenergy stakeholders and the public to make choices and overcome obstacles to entering the bioenergy supply chain. The USDA Bioenergy Project CenUSA uses the eXtension Farm Energy website to share the collective knowledge of its 80 collaborators and advisors from seven States, seven Universities, and eight Federal and Industry Partners. eXtension.org provides integration with existing materials from Extension specialists across the US, as well as providing an index in one place of CenUSA's Resources; information on bioenergy feedstock development, the production and logistics of energy crops, economic and environmental performance, and conversion into biofuel. These webpages have been accessed by 35,000 users for 48,000 page views.

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	29297	418822	740	22

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

Patent Applications Submitted

Year:	2017
Actual:	1

Patents listed
Electronic Psychrometer and/or Humidistat with Low Temperature and High Humidity Capability. United States Patent #9689819. June 27, 2017.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	7	18	25

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Class/course

Year	Actual
2017	41

Output #2

Output Measure

- Conference

Year	Actual
2017	26

Output #3

Output Measure

- Consultation

Year	Actual
2017	1822

Output #4

Output Measure

- Consumer publication

Year	Actual
2017	3

Output #5

Output Measure

- Demonstration

Year	Actual
2017	546

Output #6

Output Measure

- Discussion group

Year	Actual
2017	38

Output #7

Output Measure

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

Output #8

Output Measure

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

Output #9

Output Measure

- Field day/fair

Year	Actual
2017	2

Output #10

Output Measure

- Field site visit

Year	Actual
2017	42

Output #11

Output Measure

- Funding request
  Not reporting on this Output for this Annual Report

Output #12

Output Measure

- Presentation

Year	Actual
2017	146

Output #13

Output Measure

- Publication - curriculum

Year	Actual

2017	1

Output #14

Output Measure

- Publication - fact sheet

Year	Actual
2017	15

Output #15

Output Measure

- Publication - magazine article

Year	Actual
2017	3

Output #16

Output Measure

- Publication - manual

Year	Actual
2017	10

Output #17

Output Measure

- Publication - newsletter

Year	Actual
2017	25

Output #18

Output Measure

- Publication - newspaper/article

Year	Actual
2017	15

Output #19

Output Measure

- Research project

Year	Actual
2017	284

Output #20

Output Measure

- TV segment/Across the Fence (ATF)

Year	Actual
2017	15

Output #21

Output Measure

- Publication - technical

Year	Actual
2017	39

Output #22

Output Measure

- Tour(s)

Not reporting on this Output for this Annual Report

Output #23

Output Measure

- Mass Media - blog post/social media/web page/internet site development and updating

Year	Actual
2017	188

Output #24

Output Measure

- Workshop - series

Year	Actual
2017	18

Output #25

Output Measure

- Workshop - single session

Year	Actual
2017	78

Output #26

Output Measure

- Posters

Year	Actual
2017	5

Output #27

Output Measure

- Book Chapters

Year	Actual
2017	3

Output #28

Output Measure

- Conference Papers

Year	Actual
2017	8

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 who earn certification and apply IPM and plant diagnostic skills with home gardeners, youth and community members
3	Number of farmers who implement best agricultural practice(s) improving crop/pasture, product, and/or soil productivity while protecting water, air, soil and/or other natural resource
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	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	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	Number of growers growing organic crops increase revenues improving business sustainability
12	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 farmers who report that accessibility, cost, and associated challenges of child care are factors in their success and wellbeing
15	Number of small parcel (under 25 acres) forest landowners implementing stewardship/management activities to minimize the threat of forest fragmentation.
16	Number of identified new and sustainable disease and arthropod pest management strategies for organic agricultural growers
17	Number of research projects that studies global food insecurity.

18	Number of studies on a dairy cow's dietary regime to determine if differing regimes will enrich health-promoting bioactive fatty acids in milk.

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	43

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 who earn certification and apply IPM and plant diagnostic skills with home gardeners, youth and community members

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of farmers who implement best agricultural practice(s) improving crop/pasture, product, and/or soil productivity while protecting water, air, soil and/or other natural resource

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	184

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agricultural lands account for 38 percent of phosphorus pollution in Lake Champlain and its tributaries. Farmers require education and technical assistance to identify and implement conservation practices to reduce soil and nutrient runoff from entering nearby water.

What has been done
UVM Extension's Agronomy and Conservation Assistance Program (ACAP) assists the state in meeting goals set by the 2015 Vermont Clean Water Act (Act 64). Through outreach and technical assistance, agronomists work with farmers to implement practical strategies to keep soil and nutrients in place and out of Lake Champlain.

Results
Since the program's start in 2011, 421 farms made changes benefiting the Lake Champlain Watershed. Over two years, 195 farms implemented practices recommended by UVM Extension. Farms developed nutrient management plans, used conservation tillage and no-till planting, adopted cover crops and more. UVM Extension's assistance over this time led to improvements on 57,498 acres and a positive impact on the quality of water in Lake Champlain.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment
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

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	7

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
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
2017	1092

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 ten UVM Extension programs (i.e. Agricultural Business Management, Organic Grain Project, Vermont New Farmer Network) 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 8,150 direct points of contacts.

Results
This year, program efforts resulted in the implementation of 1,092 recommended business practices. For example, 91 farms demonstrated their commitment to safe food by creating produce safety plans through the Community Accreditation for Produce Safety (CAPS) program, representing aggregate sales of fresh produce valued at $20.6 million. The UVM Grain Research and Outreach conferences helped 71 farmers make changes like adopting grain testing, improving drying facilities and adding new crop rotations. Vermont Open Farm Week, an event co-led by UVM Extension, helped 97% of participating farms experience benefits such as increased profits and new customers. Improvements like these increase business profitability and better secure the financial future of agriculture in Vermont.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
205	Plant Management Systems
216	Integrated Pest Management Systems
315	Animal Welfare/Well-Being and Protection
601	Economics of Agricultural Production and Farm Management

602	Business Management, Finance, and Taxation
605	Natural Resource and Environmental Economics
723	Hazards to Human Health and Safety

Outcome #6

1. Outcome Measures

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
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	28

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Consumers are increasingly concerned with food safety and want assurance that food facilities have a food safety plan in place and are following its guidelines. Food safety plans are already required by state regulatory agencies. Training food facility personnel is key to increasing the implementation of food safety practices.

What has been done
UVM Extension delivered the Hazard Analysis and Critical Control Points (HACCP) class to 25 participants this year and reached an additional 305 through training related to the Food Safety Modernization Act. The initial HACCP training led to individualized interactions with 10 food facilities in Vermont needing to strengthen their food safety plans.

Results
The technical support provided to these facilities helped them to start, complete or update their food safety plans. These modifications allowed them to comply with regulatory requirements from state agencies like the Department of Health, comply with requirements by their customers and/or suppliers, or acquire new customers due to an improved food safety plan or system.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety

Outcome #7

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

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

Not Reporting on this Outcome Measure

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
2017	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation

Outcome #11

1. Outcome Measures

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
2017	57

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Organic dairy production has been the fastest growing sector of the organic market. In Vermont, certified organic dairy operations now account for a quarter (23%) of the state's total dairy farms and generate $34.1 million in gross state product. Farmers have expressed a strong need for both research- and experiential-based information to assist them in making management decisions on their farms.

What has been done
Since 2011, UVM Extension has worked in collaboration with the Northeast Organic Farming Association of Vermont (NOFA-VT) to offer annual conferences for Vermont's organic dairy producers. In 2017, the conference delivered timely organic information and practical production practices to 100 participants.

Results

An end-of event survey revealed that 97% of respondents learned new information. Of the participants who had attended previous organic dairy events, 82% made changes to their practices as a result of what they learned. These changes have allowed farmers to enhance farm viability, reduce purchased feed, improve family quality of life, and produce more milk.

4. Associated Knowledge Areas

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

Outcome #12

1. Outcome Measures

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
2017	19

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
723	Hazards to Human Health and Safety

Outcome #13

1. Outcome Measures

Number of farmers who implement key element(s) of their 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
2017	43

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Cover cropping is a practice that can mitigate production and financial risks. These crops help increase soil health, reduce soil erosion, improve water quality, and ultimately save farmers money on fertilizer and feed. However, successfully integrating cover crops into existing corn silage production systems takes advanced planning and critical timing decisions around planting and termination.

What has been done
To help farmers increase successful adoption of cover cropping, UVM Extension received funding from the Northeast Extension Risk Management Education Center to deliver research-based information on best practices for cover cropping in silage corn for norther climates. Delivery methods included a statewide conference, two on-farm field days, two YouTube videos, and a webinar series.

Results
As a result of the project, 598 livestock farmers and service providers throughout Vermont and the Northeast region gained better understanding of cover crop best practices. At least 14 farmers implemented best practices to better manage production and financial risks of implementing cover crops. Of these, seven farms are now cover cropping 100% (1,580 acres) of their corn ground. The project also enabled UVM Extension to extend its reach to more than 2,415 who viewed the webinar recordings on the YouTube channel.

4. Associated Knowledge Areas

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

Outcome #14

1. **Outcome Measures**

Number of farmers who report that accessibility, cost, and associated challenges of child care are factors in their success and wellbeing

Not Reporting on this Outcome Measure

Outcome #15

1. **Outcome Measures**

Number of small parcel (under 25 acres) forest landowners implementing stewardship/management activities to minimize the threat of forest fragmentation.

Not Reporting on this Outcome Measure

Outcome #16

1. **Outcome Measures**

Number of identified new and sustainable disease and arthropod pest management strategies for organic agricultural growers

Not Reporting on this Outcome Measure

Outcome #17

1. **Outcome Measures**

Number of research projects that studies global food insecurity.

2. **Associated Institution Types**

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food security for a growing global population could have catastrophic consequences. Factors threatening food supply include climate change and other forms of ecological degradation (conventional agriculture and dependence on non-renewable resources).

What has been done
Results from data sets such as the World Bank International Comparison Program (ICP) contain expenditures and income data for 199 countries from the year 2011.

Results
Poor people decrease consumption by a higher percentage than richer people.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics

Outcome #18

1. Outcome Measures

Number of studies on a dairy cow's dietary regime to determine if differing regimes will enrich health-promoting bioactive fatty acids in milk.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Rumen microorganisms are the key factor involved in feed utilization and metabolism and they are highly responsive to changes in diet.

What has been done
Study investigated the effects of pearl miller vs. cool season pasture on animal performance in grazing systems. Eight Holstein dairy cows were used in repeated measures design with three four-week periods (pearl millet, cool-season pasture, then pearl millet again).

Results
Forage type had no effect on animal performance (estimated dry matter intake, milk production, fat, or protein) The contents of various bioactive fatty acids were higher in milk fat of cows grazing a cool-season pasture.

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)

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

Integrated Pest Management (IPM): Soil building takes time and on some farms, investments in soil quality will take more than the duration of the project to show results; schools may lack personnel or funding to dedicate time and energy to IPM practices; growers are receptive to expand their use of IPM, but make changes in their production practices slowly to reduce negative impacts; new pesticides, biological controls and other effective IPM tactics are still being tested, and need to be assessed under field conditions before they are broadly adopted; the costs of some IPM practices are considerably higher than chemical pesticides which reduce adoption by growers; customers in general have limited knowledge of IPM, though they are willing to pay more for IPM produced products when informed of the benefits of this production approach.

Food Safety: Cost of program implementation. Cost of personnel training to understand food safety regulations. A person's perception of risk associated with foods sometimes does not match the science of food safety.

Vegetable and Berry Program: Weather; costs of production inputs such as energy; consumer demand and prices received for products sold; federal, state, and local regulations; availability of farmland and labor; ability to find relevant and timely technical information to support good production and management decisions.

Increased Population: Food and Agriculture Organization (FAO) www.fao.org (2011) estimates that population growth and greater affluence will increase the demand for food by 70% by 2050.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Farming Alternatives (Organic Dairy): farms at UVM Extension's Organic Dairy Conference were surveyed as to changes made as a result of organic dairy conference and summer series participation. 82% started soil sampling, 55% changed feed rations, 76% added new fertility sources and 45% are producing better forages.

Organic (Vegetable) Production: Vermont generates over 10 million dollars in sales of organic vegetables from approximately 1,666 acres.

Farming Alternatives (Hops): Farmers at the Hops Conference were surveyed and the following information was gained: UVM Hops program research and outreach helped farms: 64% - improve weed control, 68% - improve disease control, 64% - select low environmental impact pest measures, and 52% - helped to improve yields.

Nutrient Management Program: farmers were surveyed as to what practices they are implementing as a result of their nutrient management plan. Farmers (43) are implementing no-till, cover crops, buffer, setbacks, rotations, manure injection and proper fertilization.

Vegetable and Berry Growers Program: In an April 2017 evaluation of the Vermont Vegetable and Berry Grower Newsletter, 224 people indicated that they had used information from the newsletter on their farms or in their work.

Key Items of Evaluation

Farming Alternatives (Organic Dairy): 82% of farms started soil sampling because of information learned at UVM Extension's Organic Dairy Conference.

Farming Alternatives (Hops): 64% of farmers improved weed control because of information learned at UVM Extension's Hops Conference.

Vegetable and Berry Growers Program: 224 people are using information from the Vegetable and Berry Grower newsletter on their farms or in their work.

V(A). Planned Program (Summary)

Program # 2

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	11%		0%	
608	Community Resource Planning and Development	7%		0%	
802	Human Development and Family Well-Being	7%		0%	
805	Community Institutions, Health, and Social Services	7%		0%	
806	Youth Development	68%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	17.1	0.0	0.0	0.0
Actual Paid	21.5	0.0	0.0	0.0
Actual Volunteer	18.2	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**
582301	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
598464	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2506119	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, Arts and Math (STEAM): 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 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 with 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?

The eXtension Learning Network "Enhancing Rural Capacity" has continued to meet monthly working on several initiatives. One result of this work was UVM Extension's participation in an eXtension design-a-thon for the Foundations of Practice program.

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6838	67557	9684	551

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

Patent Applications Submitted

Year: 2017

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	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
2017	221

Output #3

Output Measure

- 4-H Day Camp

Year	Actual
2017	2

Output #4

Output Measure

- 4-H Overnight Camp

Year	Actual
2017	1

Output #5

Output Measure

- 4-H School Enrichment

Year	Actual
2017	68

Output #6

Output Measure

- 4-H Short-term/special interest

Year	Actual
2017	123

Output #7

Output Measure

- Class/course

Year	Actual
2017	3

Output #8

Output Measure

- Conference

Year	Actual
2017	10

Output #9

Output Measure

- Consultations

Year	Actual
2017	672

Output #10

Output Measure

- Discussion Group

Year	Actual
2017	23

Output #11

Output Measure

- Field Site Visit

Year	Actual
2017	1558

Output #12

Output Measure

- Funding request
  Not reporting on this Output for this Annual Report

Output #13

Output Measure

- Presentations

Year	Actual
2017	49

Output #14

Output Measure

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

Output #15

Output Measure

- Publication - newsletter

Year	Actual
2017	103

Output #16

Output Measure

- Publication - newspaper/article
  Not reporting on this Output for this Annual Report

Output #17

Output Measure

- TV segment/Across the Fence (ATF)

Year	Actual
2017	12

Output #18

Output Measure

- Train the Trainer sessions

Not reporting on this Output for this Annual Report

Output #19

Output Measure

- Workshop - series

Year	Actual
2017	10

Output #20

Output Measure

- Workshop - single session

Year	Actual
2017	78

Output #21

Output Measure

- Trainee Delivered Programming

Year	Actual
2017	96

Output #22

Output Measure

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

Year	Actual
2017	41

Output #23

Output Measure

- Publication - curriculum

Year	Actual
2017	2

Output #24

Output Measure

- Publication - technical

Year	Actual

2017	12

Output #25

Output Measure

- Display or Exhibit

Year	Actual
2017	44

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of eligible migrant youth enrolled in the Vermont Migrant Education Program
2	Number of individuals (youth and volunteers) in short term and/or afterschool programs increase STEAM related knowledge and/or skills in content and careers
3	Number of parents undergoing family transition through parentage, divorce or separation who understand the impact of these changes and their behavior on their children.
4	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
5	Number of volunteers and staff demonstrating new techniques/activities in clubs and programs to better prepare youth to develop life and job skills, learned through 4-H training and development
6	Number of individuals who use skills and effectively participate in addressing community issue(s) (e.g. green infrastructure, local leadership, hunger, volunteerism, etc.)
7	Number of participants who are English language learners increase their level of English proficiency
8	Number of communities or community group/organization(s) establishing or expanding projects to improve or mitigate a community issue

Outcome #1

1. Outcome Measures

Number of eligible migrant youth enrolled in the Vermont Migrant Education Program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	337

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Employees are a critical component of farm success and migrant workers provide an important seasonal and temporary workforce for Vermont agricultural producers. But frequent moves can be isolating for families, often disconnecting them from necessary public services and impacting the ability of migrant youth to successfully transition into post-secondary education or employment.

What has been done
The Vermont Migrant Education Program (MEP) helps families overcome these barriers by providing free educational services to children of farm-workers and young adults under 22. Through a new contract with the Vermont Agency of Education, UVM Extension is now the sole, statewide source for all supplemental educational programming.

Results
This year, 337 eligible migrant students enrolled in the program. One student's story exemplifies the importance of this work. In her last year of high school, this migrant worker set a goal of graduating in Vermont. To maintain her housing on the farm, she needed to both work and attend classes. MEP staff worked with the school, farm and student to coordinate services and schedules to make this possible. As a result of the student's concerted effort and the collective support of school and MEP staff, she graduated this June. Her high school degree has permitted her to apply to college programs in Mexico where the eventual goal is to pursue a career in business administration.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of individuals (youth and volunteers) in short term and/or afterschool programs increase STEAM related knowledge and/or skills in content and careers

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1246

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Forests help filter fresh water, supply oxygen, modulate temperatures and rainfall, provide habitat for diverse animal and plant species, and store atmospheric carbon. Because we depend so profoundly on our forests, being knowledgeable about them is crucial for all. We have a responsibility to teach our youngest citizens about the important role forests play and enable them to be responsible decision-makers and stewards of the land.

What has been done
UVM Extension 4-H's Teens Reaching Youth (TRY) for the Environment is a teen-led environmental education program that teaches environmental literacy and responsibility to Vermont youth. Using the TRY model, a six-lesson curriculum for grades 3-5 was created to increase forest literacy. Seven TRY teams (18 teens) were trained to teach the lessons. Teen teams taught the TRY Forests & Trees program to 138 students in nine classrooms at four different elementary schools in Vermont.

Results
The goal of the TRY Forests & Trees program is to help students become forest-literate so they can appreciate the importance of forests, understand concepts related to forests, communicate about them in a meaningful way, and make informed and responsible decisions about forests and forest resources. A post program survey revealed that 100% of participants increased their knowledge of forests and trees.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

Number of parents undergoing family transition through parentage, divorce or separation who understand the impact of these changes and their behavior on their children.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1108

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 #4

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
2017	815

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Youth who participate in 4-H are more likely to pursue post-secondary education. Of the 127 Vermont students who graduated from high school between 2015 and 2017 and participated in 4-H clubs, 66% went on to college compared to the state's 53%.

What has been done
The UVM Extension 4-H Program provides experiential learning opportunities for youth through its clubs, short-term special interest programs and more. This year 1,241 youth enrolled in 123 4-H clubs across the state. An additional 275 educational opportunities were offered beyond the club format and reached 5,538 youth. Those programs delivered a total of 48,768 hours of education to participating children and youth.

Results
This year 815 youth demonstrated mastery of a transferable skill like decision-making, communication or leadership because of their participation in 4-H. 4-H also surveyed graduating high school seniors from club programs for the past two years and found that: 95% say 4-H involvement helped them get into college and 83% say it helped them develop interest for a future career. Students who participate in 4-H are developing life and job skills - also known as transferable skills - that complement the classroom, support Vermont's Flexible Pathways Initiative (Act 77) and prepare them for post-secondary education.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

Number of volunteers and staff demonstrating new techniques/activities in clubs and programs to better prepare youth to develop life and job skills, learned through 4-H training and development

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	32

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #6

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
2017	26

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
802	Human Development and Family Well-Being
806	Youth Development

Outcome #7

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	39

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
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #8

1. Outcome Measures

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
2017	26

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
One urban tree annually provides its community about $100 in benefits. There are an estimated 11.9 million trees in Vermont's downtowns and village centers. Though their maintenance sustains those paybacks, only three municipalities have a paid arborist on staff. Vermont cities and towns need increased local capacity to keep urban forests healthy, safe and vibrant.

What has been done
UVM Extension's Urban and Community Forestry Program recently completed the multi-year Care of the Urban Forest Project, funded in part by the USDA Forest Service. To help move municipal tree programs forward in 20 cities and towns, the team inventoried 16,673 public trees, developed strategic action plans, and provided technical tree care training to 139 individuals.

Results
Each community now knows the composition of their trees and has a plan for their management. As one community member noted, "We now know where our urban forest stands, where it's slouching, and what steps have to be taken to help it grow up."

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.

Two issues often hinder the effective planning and management of Vermont's urban and community forestry resource: 1) a need for greater awareness that urban and community forests that are planned and designed as green infrastructure will become valuable components of sustainable communities, and 2) a need for political and human capital to manage this resource.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

4-H Youth Development: 100 TRY teen teachers and 849 youth grades K-5 increased their STEAM related knowledge or skills in content and careers. The teens were assessed by written reflections and visual observations and the K-5 youth were assessed with a written quiz at the end of the TRY program.

Tech Wizards Program: students were evaluated based on their demonstration of life skills such as critical thinking, communication, decision-making, and leadership. Evaluation of skills also included teacher observation of students' ability to use simple equipment, organize, represent and interpret data. 378 students demonstrated these skills in the following Tech Wizards programs: Flight, Robotics, Simple Machines, Wonderwise Vet, and Simple Machines.

Key Items of Evaluation

100 "Teens Reaching Youth for the Environment" teen teachers and **849** youth grades K-5 increased their STEAM related knowledge or skills in content and careers.

378 students demonstrated life skills in the following Tech Wizards programs: Flight, Robotics, Simple Machines, Wonderwise Vet, and Simple Machines.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Variable Weather

☑ 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%		14%	
112	Watershed Protection and Management	0%		8%	
121	Management of Range Resources	0%		12%	
123	Management and Sustainability of Forest Resources	5%		23%	
125	Agroforestry	0%		3%	
131	Alternative Uses of Land	0%		2%	
132	Weather and Climate	18%		15%	
133	Pollution Prevention and Mitigation	44%		10%	
136	Conservation of Biological Diversity	0%		6%	
205	Plant Management Systems	0%		2%	
601	Economics of Agricultural Production and Farm Management	18%		0%	
602	Business Management, Finance, and Taxation	15%		0%	
704	Nutrition and Hunger in the Population	0%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	2.4	0.0	4.0	0.0
Actual Paid	2.6	0.0	11.0	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**
70231	0	386000	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
72181	0	734546	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
302262	0	55550	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.

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

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.

Food Security - increasing focus on understanding the effects of variable weather on agricultural systems, including necessary adaptations to ensure future food security.

Maple Production - research and extension efforts at the Proctor Maple Research 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.

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 alternative 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
Hops 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
Academia; graduate and undergraduate students
Conservation professionals

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2739	3720	0	0

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

Patent Applications Submitted

Year:	2017
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total

Actual	0	22	22

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Research Projects

Year	Actual
2017	22

Output #2

Output Measure

- Consultations

Year	Actual
2017	549

Output #3

Output Measure

- Workshop Series

Year	Actual
2017	20

Output #4

Output Measure

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

Year	Actual
2017	145

Output #5

Output Measure

- Publication - popular press

Year	Actual
2017	18

Output #6

Output Measure

- Focus Groups
  Not reporting on this Output for this Annual Report

Output #7

Output Measure

- Research Conferences

Year	Actual
2017	3

Output #8

Output Measure

- Presentations

Year	Actual
2017	36

Output #9

Output Measure

- Workshop (single session)

Year	Actual
2017	76

Output #10

Output Measure

- Field Day

Year	Actual
2017	2

Output #11

Output Measure

- Conference Papers

Year	Actual
2017	6

Output #12

Output Measure

- Journal Articles

Year	Actual
2017	5

Output #13

Output Measure

- Seminars

Year	Actual
2017	2

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 drivers completing a personal pledge to embrace 'Eco-driving' practices
8	Number of eRating certified vehicles
9	Number of small parcel (under 25 acres) forest landowners developing a management plan and goals to minimize the threat of forest fragmentation
10	Number of research projects that records climate change responses in northeastern red spruce forests
11	Number of case studies that determine the origin of the invasive knapweed hybrid species Centaurea moncktonii in Vermont and eastern North America.

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 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	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
Developed a transdisciplinary research methodology to address climate change in agricultural landscapes, identified and evaluated promising climate change best management practices (CCBMPs), and created opportunities for farmer to farmer interactions regarding CCBMPs.

Results
Methods developed have been used to train farmers and 40 undergraduate students in landscape visualization techniques.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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
2017	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships

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
2017	48

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is a need to improve sustainability in the passenger transportation sector to address global climate change. The US Department of Energy reported that Americans burn around 6 billion gallons of fuel each year while their vehicles are idling - half of which comes from heavy-duty diesel vehicles. In the US 25% of carbon dioxide (CO2) emissions can be attributed to transportation activities; 73% of these emissions come from passenger transportation.

What has been done
The Certification for Sustainable Transportation (CST) offers driver-training and certification designed to help companies and individuals eliminate unnecessary idling while also promoting fuel-efficient driving practices. CST certified 48 companies, engaged 685 new drivers, and issued 2,499 eRating certifications this year.

Results
To date, CST has worked with 82 transportation companies in 40 states, two Canadian provinces, and the territory of Guam. They have issued approximately 12,700 vehicle and/or driver certifications to participants. CST estimates that it has helped companies reduce fuel consumption by 2-8% annually. This represents a potential annual cost savings for companies of $1,969,367 to $7,885,209. CST programs help address priority areas identified by our federal government related to improving community and economic development, promoting the use of multi-modal forms of transportation, reducing dependence and use of fossil fuels and mitigating climate change.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

133 Pollution Prevention and Mitigation

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
2017	82

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
133	Pollution Prevention and Mitigation

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
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	198

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
132	Weather and Climate
205	Plant Management Systems

Outcome #7

1. Outcome Measures

Number of drivers completing a personal pledge to embrace 'Eco-driving' practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2017	685

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 #8

1. Outcome Measures

Number of eRating certified vehicles

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	2499

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 #9

1. Outcome Measures

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
2017	29

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. There is a growing gap of educational and technical assistance programs for this new and growing landowner audience. There is an opportunity to engage this transitioning audience as stewards of Vermont's changing forests.

What has been done
To engage this audience, UVM Extension in partnership with Vermont Department of Forests, Parks and Recreation, has developed a Backyard Woods Online Course. The course is targeted toward homeowners of 2-10 acres and is designed to 1) get these landowners out into their woods and 2) to develop backyard woods action plans. The six week course is a hybrid of online learning modules, live webinars and an in-person field day.

Results
The Backyard Woods Online Course engaged 40 participants with their property last year and helped 29 of them to develop a personalized backyard woods action plan. From managing invasive species to attracting pollinators, participants are making changes to support the health and well-being of Vermont's forests - one backyard at a time.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

Outcome #10

1. Outcome Measures

Number of research projects that records climate change responses in northeastern red spruce forests

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Climate change has already begun to affect the structure of our forests. The Vermont community is interested in learning about the decline of forests and potential losses to tree varieties.

What has been done
Data was conducted on forest inventory plots on Camel's Hump mountain, adding a 50 year monitoring record documenting change in forest composition with elevation.

Results
Results have suggested that climate warming over the latter half of the 20th century has resulted in an upslope movement of the boreal spruce-fir forest. This could lead to potential loss of spruce abundance and resiliency in northeastern forests.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
136	Conservation of Biological Diversity

Outcome #11

1. Outcome Measures

Number of case studies that determine the origin of the invasive knapweed hybrid species Centaurea moncktonii in Vermont and eastern North America.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Invasive plants can cause irreversible damage to Vermont ecosystems. Although they might not start out that way, they may evolve to be invasive in their new range. One way in which species can evolve to become more invasive is through hybridization between two related species creating a third new species that is more aggressive than the other two parental species. Being able to identify the source of the invasive Centaurea populations is the first step in being able to control the most aggressive populations.

What has been done
Research will investigate whether this hybridization event is responsible for the increase in invasiveness of Centaurea sp in Vermont and throughout New England. Studies will determine the degree of hybridization in Centaurea populations and whether this hybridization is occurring in the United States or whether hybridization has occurred in Europe.

Results
Used genomic analysis to determine the species identity. Most in Vermont show that the invasive knapweed are either F2 hybrids between Centaurea jacea (native to Europe) and Centaurea nigra (native to Europe) or backcrossed between Centaurea jacea (native to Europe) and the hybrids. In addition, collected knapweed from 22 locations in Europe. At each site, they collected 16 individuals for genetic analysis. Future analysis will analyze the genomics of the European collected plants.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range 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

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.

July 20, 2017 the governor announced the creation of the Vermont Climate Action Commission (VSAC) to provide recommendations to decrease greenhouse gas and meeting energy needs from renewable sources.

Variable weather has reduced the length of maple production, a Vermont specialty crop, by 10% over the past 50 years.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Sustainable Forests: 28 participants identified management goals and implemented at least one stewardship activity within six months of completing the Backyard Woods Program, based on a post-program survey.

Key Items of Evaluation

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%		13%	
202	Plant Genetic Resources	0%		2%	
205	Plant Management Systems	0%		15%	
206	Basic Plant Biology	0%		20%	
601	Economics of Agricultural Production and Farm Management	0%		35%	
605	Natural Resource and Environmental Economics	0%		15%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.6	0.0
Actual Paid	0.0	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.5	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	8270	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	59957	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Renewable energy workshops

Economic feasibility and market potentials for oilseed and farm-scale biodiesel production

Plant cell wall research as a potential source of biofuels.

Methane Biodigesters (Cow Power Program)

2. Brief description of the target audience

- Community members
- Research scientists
- Dairy Farmers
- Policymakers
- Extension educators

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2017	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:	2017
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	0	3	3

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Workshop - single session

Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Research Projects

Year	Actual
2017	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of research studies that access the financial and economic feasibility of converting cow manure into renewable energy products
2	Number of research findings that propose using plant cell walls as a source of biofuels

Outcome #1

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
2017	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many American dairy farms, especially small and medium farms, have been struggling to stay in business and, as a result, the number of dairy farms has declined steadily across the U.S. in the past three decades. Although many factors have contributed to the problems faced by dairy farms, rising production costs and fluctuating farm gate milk prices are the major concerns. Converting cow manure and other agricultural wastes into biogas, electricity, and other marketable products via anaerobic digester systems (ADS) is one avenue for some dairy farmers to diversify their production practices and increase farm income.

What has been done
This study assesses the energy outputs and financial returns of ADS by farm size through case studies in Vermont. These financial indicators; return on equity (ROE), return on asses (ROA), net present value (NPV) and internal rate of return (IRR) are expected to help farmers when deciding whether to purchase an ADS.

Results
Results show that farms with a herd size (COWS) of 75-500, the initial investment would be $1.3 million and farms with a herd size of 501-2100, the initial investment would be $2.4 million.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics

Outcome #2

1. **Outcome Measures**

Number of research findings that propose using plant cell walls as a source of biofuels

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Vermont Energy Act of 2009 policy for renewable energy plants. The public service board "shall set the price to be paid to a plant owner... to include a rate of return on equity (ROE) received by a Vermont investor-owner retail electric provider."

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The number of operating ADS on Vermont farms has increased reaching a total of 16 by December, 2014. The development of ADS in Vermont has been closely associated with the Cow Power program.

Key Items of Evaluation

The program is a financial "first come, first served" situation for those supplying power to the electrical grid. When supply exceeds demand, the newest farms to come online with ADS do not receive a premium from local electricity customers, but can sell their renewable attributes on the Renewable Energy Credits (RECs) market for a premium.

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	5%		0%	
607	Consumer Economics	5%		0%	
703	Nutrition Education and Behavior	7%		20%	
704	Nutrition and Hunger in the Population	27%		0%	
724	Healthy Lifestyle	17%		49%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%		7%	
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures	0%		17%	
805	Community Institutions and Social Services	39%		0%	
903	Communication, Education, and Information Delivery	0%		7%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	6.3	0.0	3.0	0.0
Actual Paid	7.4	0.0	5.0	0.0
Actual Volunteer	0.3	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**
199060	0	226427	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
204586	0	338293	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
856720	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.

Local Foods/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.

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.
- Whether crowdsourcing can generate novel ideas to further insight into what men think about weight and weight loss.
- Incentivizing physical activity using gamification.

- Using a diet tracking smartphone app with image capture.

2. Brief description of the target audience

Age 19-24 Youth
Age 6 - 12 Children
Age 60 - Seniors
Agriculture: Beginning Farmers
Agriculture: Home Gardeners
Agriculture: Migrant workers
Agriculture: Resettled Refugee Families
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
Overweight and Obese Men
Dairy farmers
Dairy food industry
Academia
Veterinary and health personnel
Teachers
School Administrators
Parents
Dietitians
Nutrition Scientists
Health professions
Culinary instructors
Hospitality program coordinators

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	972	0	23	0

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

Patent Applications Submitted

Year:	2017
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	0	8	8

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Consultation

Year	Actual
2017	169

Output #2

Output Measure

- Workshop Series

Year	Actual
2017	35

Output #3

Output Measure

- Workshop - single session

Year	Actual
2017	14

Output #4

Output Measure

- Presentations

Year	Actual

2017	2

Output #5

Output Measure

- Radio

Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Television

Not reporting on this Output for this Annual Report

Output #7

Output Measure

- Demonstration

Year	Actual
2017	8

Output #8

Output Measure

- Research Project

Year	Actual
2017	27

Output #9

Output Measure

- Field Site Visits

Year	Actual
2017	16

Output #10

Output Measure

- Conference

Not reporting on this Output for this Annual Report

Output #11

Output Measure

- Publication: Evaluation Instrument

Year	Actual
2017	5

Output #12

Output Measure

- Conference Papers

Year	Actual
2017	1

Output #13

Output Measure

- Journal Articles

Year	Actual
2017	5

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 select and prepare a variety of produce to help prevent/manage disease and/or obesity
3	Number of weight loss programs that help/reduce adult obesity.
4	Number of individuals who take steps to meet daily needs for health, education, social and personal wellbeing
5	Number of "food agency" methods that were developed to assess the connection between food involvement, cooking skill and healthful eating.

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	94

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
724	Healthy Lifestyle
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #2

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of weight loss programs that help/reduce adult obesity.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Depending upon an individual's dietary needs, there are a number of research programs that focus on specific needs. This is important because not every weight loss program works the same for each individual.

What has been done
There has been a number of research studies underway to see if different dietary approaches are beneficial to different social groups.

Results
Evidence based approaches that engage men in initial weight loss maintenance, mobile gaming app to incentivize physical activity for Vermont's highschool students, and smartphone technology for students, educators, and the public to self monitor, are dietary programs currently being researched.

4. Associated Knowledge Areas

KA Code	Knowledge Area

703	Nutrition Education and Behavior
724	Healthy Lifestyle
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

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
2017	189

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Burlington Vermont is home to thousands of resettled refugees, many of whom have farming and gardening backgrounds. They are accustomed to growing their own food as a way to save money, build a sense of community, partake in healthy exercise and lifestyle, and supply the household with culturally important food. There is a lack of space for gardening and farming in Burlington. Moreover, the resettled refugees are largely from sub-tropical countries and there is a significant knowledge gap on how to grow food successfully in cold climates.

What has been done
In 2016-2017, UVM Extension, in partnership with the Association of Africans Living in Vermont, initiated a three year project to help resettled refugee farmers and gardeners implement practices to extend the growing season and increase the production of healthy food. The project team led a three part workshop series involving a core group of 14 gardeners to teach season extension practices such as low tunnels, cold frames and row covers.

Results
Research has shown that $25 dollars can be saved for every dollar spent on seeds and gardening techniques for growing one's own food. The economic impact of supporting gardening activity is significant. The gardeners who participated in the workshops all reported an increase in knowledge of season extension practices. All have reported plans for or current implementation of at least one season extension practice to increase production of healthy food beyond the

standard growing season. Because gardening among resettled refugees is often done in a family or community setting, there is significant potential for this new knowledge to be shared with a larger family or community group.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Number of "food agency" methods that were developed to assess the connection between food involvement, cooking skill and healthful eating.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Improved understanding in this area will be useful for public health interventions to improve diet quality and prevent obesity and other diet related diseases.

What has been done
The goal was to develop a set of mixed methods tools to identify and assess food agency, to develop a "portable" experiential pedagogy that demonstrably increases food agency and to investigate the relationship between food agency and other observable behavioral and demographic characteristics.

Results
A pilot scale for measuring Food Agency called Cooking and Food Provisioning Action Scale (CAFPAS) has shown promising psychometric properties and predictive capacity towards reported incidences of home cooking.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

2015 Dietary Guidelines for Americans.
USDA National School Lunch Program implemented regulation requiring children to select a fruit or vegetable with their school lunch.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Interviews were conducted with resettled refugees regarding food security. Analysis of these interviews will result in some recommendations about the national food security measurement tool. Analysis is still underway.

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%		14%	
215	Biological Control of Pests Affecting Plants	0%		12%	
216	Integrated Pest Management Systems	0%		8%	
311	Animal Diseases	0%		5%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	0%		5%	
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%		5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%		22%	
722	Zoonotic Diseases and Parasites Affecting Humans	0%		2%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%		4%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	5.0	0.0
Actual Paid	0.0	0.0	15.0	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	169838	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	276615	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	1527656	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research - develop methods for detection and evaluate potential for growth and survival of pathogens of concern to Vermont artisan cheese makers.

Food Safety - working with small scale producers on best practices that enable them to provide a safe food product.
Pest Management - understand rapid pest evolution and improve sustainable pest management for food safety

2. Brief description of the target audience

- Small scale meat and produce farmers
- Artisan cheese makers and consumers
- Researchers
- Graduate and undergraduate students

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2017	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: 2017

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2017	Extension	Research	Total
Actual	0	9	9

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Research Projects

Year	Actual
2017	2

Output #2

Output Measure

- Publications

Year	Actual
2017	1

Output #3

Output Measure

- Presentations

Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Conferences

Year	Actual
2017	2

Output #5

Output Measure

- Papers

Year	Actual
2017	12

Output #6

Output Measure

- Journal Articles

Year	Actual
2017	8

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of research projects working with farmers to improve food safety of artisan cheeses.
2	Number of strategies that best detects the presence of Listeria in milk used for artisan cheese making.
3	Number of differing crystal characteristics that enhance the value of artisanal cheeses

Outcome #1

1. Outcome Measures

Number of research projects working with farmers to improve food safety of artisan cheeses.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
503	Quality Maintenance in Storing and Marketing Food Products
607	Consumer Economics
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
722	Zoonotic Diseases and Parasites Affecting Humans

Outcome #2

1. Outcome Measures

Number of strategies that best detects the presence of Listeria in milk used for artisan cheese making.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Consumer interest in artisan and farmstead cheeses is driving explosive growth of on-farm cheese operations throughout the United States and Vermont. As many of these enterprises are small to very small establishments, there is a need for focus on assuring the microbiological safety of cheese produced on farm. In order to allow this industry to grow, it is essential that the safety of artisan cheese be assured.

What has been done
Research compared novel and traditional testing systems encompassing microbiological monitoring of the quality and safety of milk, cheese and the cheesemaking environment.

Results
The project studied six farms. In the study, they could not detect the presence of listeria in bulk tank milk; however, when milk filters were tested, the presence of the pathogen was revealed below the normal detection levels. Farmers have been encouraged to routinely test milk filters as it may be the most effective way in identifying potential presence of Listeria in milk.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Number of differing crystal characteristics that enhance the value of artisanal cheeses

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2017	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
New knowledge about cheese crystals will enhance consumer appreciation for the uniqueness of artisanal cheeses, thereby enhancing the sensory experience of consumers for these cheesemaker and cheese mongers with new and valuable information about prominent crystals that form in artisanal cheeses. Enhanced consumer willingness to pay for artisanal cheese will help to sustain working agricultural landscapes in regions such as Vermont that depend on value-added niche markets for the economic vitability of their agricultural enterprises.

What has been done
Research looked at Vermont-made washed rind cheeses for the presence of crystals using powder x-ray diffractometry, polarized light microscopy, and single crystal x-ray diffractometry.

Results
Hard, bright white particles that abundantly form throughout the body of Parmigiano-Reggiano during aging consist of crystals of the amino acid tyrosine. Tyrosine crystals are important because they impart a desirable crunchy, granular texture to long aged grana cheeses such as Parmigiano-Reggiano. Results indicate that amino acid crystallization contributes more to the texture of hard grana cheeses. Research loked at washed rind cheesemaking. The crystals did not consist of brushite, but rather of iKaite and ikaite plus truvite. The use of sea salt in washed rind cheesemaking may have important implication for struvite crystallization.

4. Associated Knowledge Areas

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

803	Sociological and Technological Change Affecting Individuals, Families, and Communities

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.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Consumer interest in artisan and farmstead cheese is driving explosive growth of on-farm cheese operations throughout the United States and in Vermont. With 38 artisan cheese producers, Vermont boasts the highest number of artisan cheese makers per capital in the United States. Many of Vermont enterprises are small to very small establishments. In addition, the retail of artisan cheese has become one of Vermont's value-added niche markets. With this comes a focus on assuring the microbiology safety of cheese produced on the farm. In order to allow this industry to grow and prosper, it is essential that the safety of artisan cheese be assured.
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.

Key Items of Evaluation

Results have shown that contaminated silage can be an important reservoir of the listeria pathogen in a dairy farm setting. At the national level, information regarding listeria has been shared at the International Association for Food Protection and the American Cheese Society Annual Conference. In Vermont, the focus has been on farm visits and environmental surveillance to identify and mitigate the sources of Listeria in order to reduce or eliminate this pathogen in milk intended for artisan cheese production.

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)	
1353	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.