



University of Vermont Research and Outreach That Benefits Vermonters



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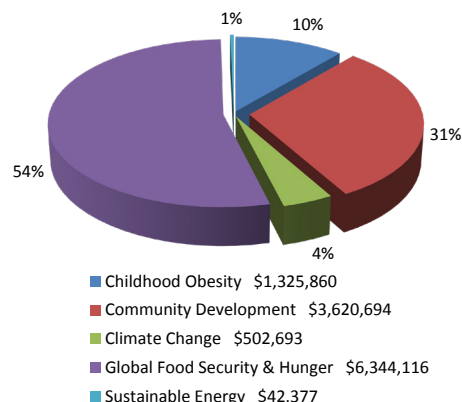
Annual Report 2015



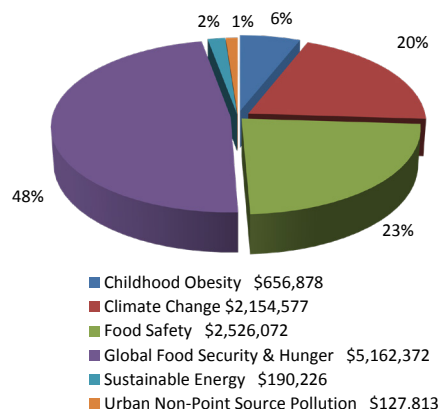
University of Vermont Paul R. Miller Research
and Educational Center Miller Farm

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**UVM Extension Budgeted Dollars
by National Goal Area FY 2015**



**VT Agricultural Experiment Station
by National Goal Area FY 2015**



Why are Research and Outreach Important to Vermonters?

Tom Vogelmann, Dean and Director of the Vermont Agricultural Experiment Station (VT-AES) and UVM Extension Dean and Director, Doug Lantagne, cooperate to translate VT-AES research into UVM Extension's science-based programs to benefit Vermonters. They manage over \$26.6 million in state, federal and other grants and contracts and are accountable to the University, state and federal leaders and the people of Vermont. That is why this annual report is published each year.

Faculty and staff at the Agricultural Experiment Station (VT-AES) and University of Vermont Extension (UVM Extension) are focused on meeting the needs of the state's citizens. These experienced and innovative professionals continually work to integrate higher education, research and outreach to protect and enhance a quality of life characterized by a thriving natural environment, a strong sense of community, and a deeply rooted connection to agriculture. Though these research conclusions offer lessons nationwide, even globally, UVM-VTAES and UVM Extension apply the results closer to home, in our own communities, helping people where they live, and cultivating healthy communities.



Tom Vogelmann, Dean
Vt Agricultural Experiment Station

VTAES and UVM Extension study relevant research that helps:

- Farmers
- Forest and land stewards
- Children and families
- Rural community members
- Environment
- Economics
- Nutrition
- Food Safety
- Youth and adult life-skills development



Douglas Lantagne, Dean
UVM Extension

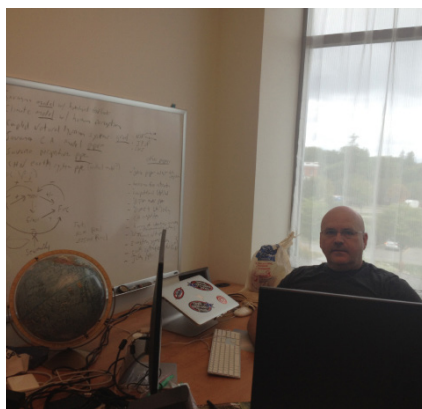
Today, research ranges from farm profitability, quality of life in our food system, water and soil quality, and dairy herd disease resistance and health; to global climate change, renewable energy, youth life skills education, community development and planning; and obesity, nutrition and health.

In conclusion, as we look to the future, VT-AES and UVM Extension see growing opportunities to provide leadership at the University and throughout Vermont. As the state's clean water legislation, Act 64, is implemented, VT-AES and UVM Extension will continue to engage in research and outreach to improve water quality in the state's watersheds. The continuing concern with food borne illness and new rules on food safety have wide-ranging impacts on small, diversified farms. VT-AES and UVM Extension will continue to explore jointly funded integrated research and outreach projects to enhance and support Vermont food systems, as well as other community, business and youth development efforts.

Our goal is to put our health, environment and agricultural research into action, resulting in improved sustainability, human health, community development and the personal and intellectual development of youth through interdisciplinary and integrated work.

BRIAN BECKAGE, PROJECT INVESTIGATOR

Climate Change Will Alter Vermont's Forests



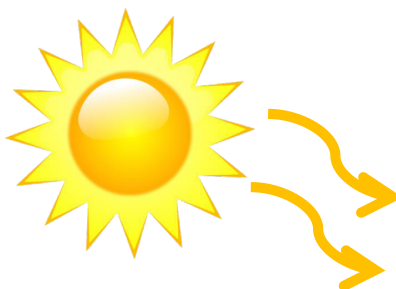
Brian Beckage, Project Investigator

Dr. Brian Beckage is a professor of ecology in the Department of Plant Biology. He is interested in population and community dynamics including tree demography, maintenance of species richness and the ecological effects of climate change. His research emphasizes the use of quantitative approaches to investigate the structure of ecological systems, including statistical models, analytical models, and simulation models.

Why is this research important?

- Global climate is rapidly changing with the largest effects in higher latitudes;
- Forests across New England are expected to respond through shifts in species distribution and composition;
- Changes in Vermont's climate will affect agriculture and tourism.

Process-based vegetation models (PBMs) provide a mechanistic basis for projecting the distribution of forest trees in response to future climate change. Improving the inputs and application of PBMs to project future forest distribution is a key step towards early identification of likely impacts of climate change on Vermont forests.



Climate Change Vermont Vermont Landscape

Dr. Beckage uses high-tech models called process-based vegetation models to estimate risks and changes to Vermont's forests. Projections give possible scenarios of what forest compositions could look like. Beckage has found that New England forests are shifting "upslope" to higher elevations and further north.

Vermont Maple Syrup

Vermont is the largest supplier of maple syrup in the United States, annually making over 5% of the global supply. Beckage found that Vermont forests, including sugar maples, are moving upslope and further north. The shift threatens the potential for beautiful fall foliage that tourists and Vermonters love.

Reduce Uncertainties

Vermont's landscape is changing and these changes can impact the maple and tourist industries. Beckage's model allow citizens, business owners and policymakers to anticipate what Vermont will look like in the mid to late 21st century. Based upon these predictions, Vermonters can adopt business models and policies to help shape the future of maple and tourist industries.

Improving Soil Health & Water Quality Through Collaboration

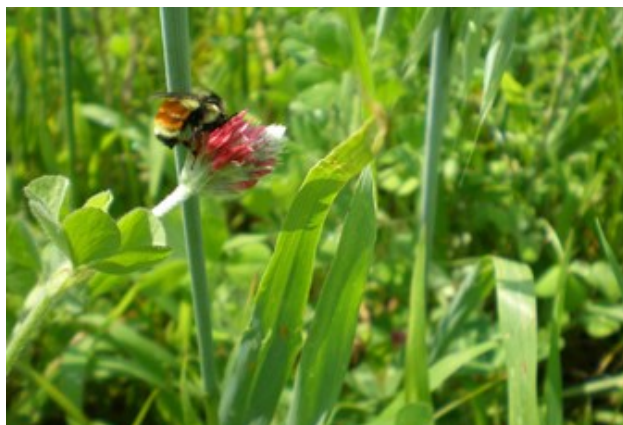
2015 was declared International Year of Soils by the UN General Assembly – to highlight and celebrate the critical connection among healthy soils, food security, water quality, functioning ecosystems, and emerging resilience in the farming community to a changing climate.

In Vermont, phosphorus and soil that moves off-site from agricultural lands has been identified as a significant cause for diminished water quality in the Lake Champlain Basin (including Otter Creek and the Missisquoi, Lamoille, Winooski and Mettawee River watersheds). Across the state, UVM Extension has tasked faculty and staff to conduct applied research, improve management practices, and develop solutions which lead to enhanced soil health and better water quality.

As a result, UVM Extension professionals in collaboration with the Agronomy and Conservation Assistance Program (ACAP) provided outreach education and direct technical assistance to 260 farmers in the Lake Champlain watershed (from 2011 through 2014) to implement 461 farm practices that reduce soil and nutrient losses to surface water.

Poor soil health in agricultural fields limits water infiltration, nutrient utilization and crop productivity. In contrast, healthy soil is high in organic matter, limits erosion and related nutrient/soil runoff when always continuously planted with a cover crop. The goal is to have living, growing plant coverage twelve months a year.

Farmers and agricultural professionals, working together, gain a better understanding of the relationships between agricultural conservation practices to improve soil health and water quality -- and the positive effects on profitability from lower farm input costs. Reduction of pollution into surface waters provides clean water for public recreation, tourism and many other uses.



Healthy soil is high in organic matter and creates a thriving ecosystem for many living organisms, including pollinators. (Photo: Champlain Valley Crop, Soil and Pasture Team)



A highboy seeder is used to plant a cover crop in between rows of corn, without damaging or disrupting growth of the plants. Cover cropping is used to limit soil erosion and nutrient runoff, both of which contribute to degraded water quality. (Photo: Northwest Crops and Soils Program)

ACAP-At-a-Glance in the Lake Champlain Basin

1 WATERSHED

fed by **5 RIVERS** > Missisquoi, Lamoille, Winooski, Mettawee & Otter Creek



260 FARMS implemented

461 CONSERVATION PRACTICES to limit erosion & soil/nutrient runoff on

58,608 ACRES crop/livestock production including:

Alternative Manure Management

28 farms > 8,109 acres

Nutrient Management Planning

47 farms > 20,897 acres

Reduced Tillage & No-Till Planting

164 farms > 13,559 acres

Cover Cropping

125 farms > 12,360 acres

ERNESTO MENDEZ, PROJECT INVESTIGATOR

Climate Change, Farmers, and Resilience



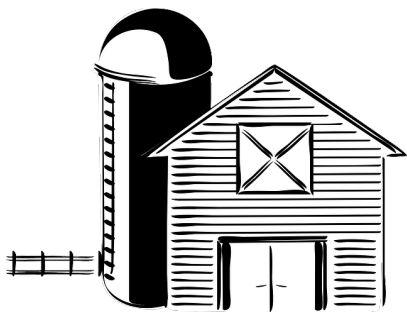
Ernesto Mendez, Project Investigator

The faculty, graduate students, and staff who are a part of the Vermont Agricultural Resilience in a Changing Climate Initiative (VAR) know that Vermont farmers are concerned about climate change. Dr. Ernesto Mendez, one of the VAR faculty leads from the Plant and Soil Science Department-PSS, seeks to better understand the interactions among farmer management (i.e., climate change best management practices - CCBMPs) and decision making with the current and alternative policy regimes addressing climate change. Drs. Stephanie Hurley (PSS), E. Carol Adair (Rubenstein School), Christopher Koliba (Community Development and Applied Economics-CDAE), David Conner (CDAE), and Joshua Faulkner (CSA) and their teams work together to research the impacts of climate change on agriculture in the Northeast, and disseminate their finding through outreach and education efforts including trainings, workshops, and on-farm field days.

Giving Vermont Farmers Tools to Adapt to Climate Change

Farmers are Concerned about Climate

Change; In 2011, Tropical Storm Irene caused over \$10 million of crop loss and land damage in the state of Vermont. Many farmers are worried about their farms and unsure of how to keep their crops safe from flooding or drought.

**Better Management Practices Can**

Prevent Damage to Farms. The VAR approach focuses on practices that farmers can use to keep farms safe – cover crops, rotational grazing, no-till cultivation, storm water management and wetland conservation.

Current Incentive Programs are Hard to Adopt. To keep farms safe in the future, the VAR team suggests implementing best management practices today. However, research by the VAR initiative shows that incentive programs are expensive, complicated, and time-consuming for farmers. If these programs were more accessible, farmers would be more likely to implement these best management practices.



VAR team members attend a field day in Alburgh, Vt. organized by VAR team member Dr. Heather Darby. From left to right-Linda Berlin, Stephanie Hurley, Ernesto Mendez, Carol Adair, and Tyler Goeschel.



Joshua Aldred, Rory Shamlian, and Hannah Aitken lay black plastic mulch at Bella Farm in Monkton, Vt. Photo courtesy of Rachel Schattman.

Helping Youth Adopt & Use Skills For a Lifetime

Learning skills to last a lifetime is at the heart of UVM Extension positive youth development programs. Life skills are abilities individuals can learn and use to be successful in living a productive and healthy life. Personal mastery of life skills is important for both positive family and youth development, as well as future professional or workforce development.

During the 2015 program year, more than 13,000 Vermont youth (pre-K through high school) were engaged in many UVM Extension program areas such as:

- Traditional 4-H activities and teen leadership
- Special-interest STEM (science, technology, engineering, mathematics)
- Agricultural safety and beginning farming
- Water stewardship, natural resources, environmental action
- Migrant student educational support
- Youth and family resilience, healthy lifestyle choices

UVM Extension youth and family development activities throughout Vermont provide positive opportunities for youth to learn and practice life skills, and expand knowledge.

Life skills focused on in youth programming include critical thinking and decision making; wise use of resources; communication; appreciating differences, teamwork and collaboration; leadership and useful/marketable skills; and healthy lifestyle choices and personal responsibility.

The goal of UVM Extension youth development programs is to provide developmentally appropriate opportunities for youth (and adults) to experience life skills, practice them until they are learned, and use them throughout a lifetime.



4-H robotics, a STEM activity, provides hands-on learning experiences to ensure global competitiveness and prepare the next generation of science, engineering, and technology leaders. (Photo: National 4-H Council)



TRY (Teens Reaching Youth) for the Environment is a teen-led leadership program. Students in grades 7-12 teach environmental literacy and responsibility to younger students in three program areas—renewable energy, waste solutions, food systems—helping young people experience real-world environmental problems and create real-world solutions. (Photo: Lauren Traister)



Mastery of life skills is key to personal growth and future professional or workforce development. (Reprinted with permission from the author. Iowa State University Extension and Outreach. Targeting Life Skills Model, P. Hendricks. 1996.)

KATHLEEN LIANG, PROJECT INVESTIGATOR

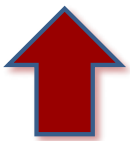
Vermont Farmers Work Together to Market Local Wines and Communities



Vermont's small-scale artisan wine industry allows producers to build strong relationships with customers. Vermont wine producers are involved in every stage of the winemaking process. All manufacturing is done in Vermont which provides intimate relationships with the producer and the consumer.



Vermont's wine industry collaborates to promote the "Vermont brand." Vermont winemakers work together to promote the state's wine industry. They emphasize the unique produce and production techniques used to make Vermont wines. Dr. Liang found that promoting the "Vermont brand" helps to bring tourists to the state and supports the growth of Vermont's wine industry.

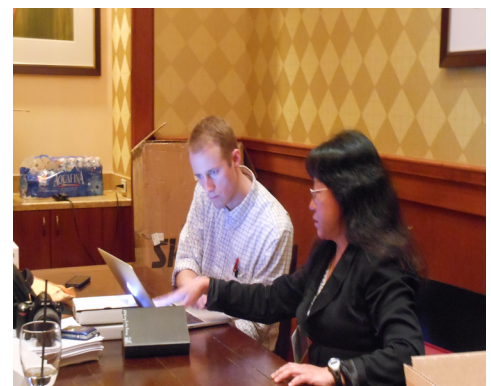


Vermont's wine industry grows with research. Vermont wineries are an important and growing sector of Vermont's agricultural industry. Dr. Liang uses her knowledge of effective promotional strategies and consumer behavior to educate winemakers. Her educational materials help winemakers take better advantage of networks for marketing their products.



Kathleen Liang, Project Investigator

Dr. Kathleen Liang is a Professor in the Department of Community Development and Applied Economics. Her research focuses on many perspectives of entrepreneurship and its interactions with people, communities, and organizations. Her research on wineries shows that wineries use marketing strategies that create customer loyalty and bring tourists to Vermont, promoting local wines that benefit wineries, businesses, and communities.



Dr. Liang working with a project technical assistant.

Rising Demand for Locally Grown Small Grains

The increasing demand for locally produced small grains—including wheat, oats, and barley—by local millers and bakers, maltsters and distillers, and consumers has created market opportunities for farmers. However, farmers face many obstacles in their efforts to fill this demand including meeting the strict standards required for sale of grain into the food grade market.

The University of Vermont Extension's Northwest Crops and Soils program, in partnership with the Northern Grain Growers Association and the University of Maine Cooperative Extension, has been working to enhance capacity of farmers to produce high quality and high yielding grains to fill the rising demand.

Since 2009, the program has evaluated hundreds of grain varieties in climate and conditions experienced in Vermont. Cultivars have been identified that perform best in our region under optimal management practices for organic grain production. These adapted varieties will help farmers combat local climate and pest issues helping them be more successful.

For farmers, this collaboration has led to increased grain yields, improved grain quality, connections with new buyers and markets, increased or maintained employment, and increased wheat acreage. The economic value farmers placed on the benefits they gained was an average of \$7,000 each. For millers, this value was over \$35,000 each.

Grains production in Vermont, once dubbed the “bread basket of New England” in the 1800s, is once again on the rise.



Improved grain varieties are helping farmers in the region meet the demands of value-added producers such as bakers and are creating a renaissance for the Vermont grain-growing industry. (Photo: Northwest Crops and Soils Program)



Barley, one of the first cereal grain crops to be domesticated for human consumption, is used heavily in beer production. The micro-brew industry continues to grow in Vermont and along with it, the need for locally grown barley which meets malting quality standards. (Photo: Northwest Crops and Soils Program)

Cutting Through the Chaff: Grains History, Outreach, Research

CYRUS PRINGLE (1838-1911), botanical expert, developer of Vermont heirloom grain varieties, from Charlotte, Vt.

PARTNERSHIP to enhance farmer production capacity/meet market demands: UVM Extension NW Crops and Soils, Northern Grain Growers Association and University of Maine Cooperative Extension (2009)

Evaluated hundreds of heirloom and commercial **WHEAT, BARLEY, AND OAT VARIETIES**

Research results shared with
+1,000 FARMERS, BAKERS, BREWERS
through +20 on-farm field days, workshops, conferences

Survey of **30 NEW ENGLAND GRAIN GROWERS** reported increased grain yields, improved quality, connections with new buyers AND indicated average economic value of \$7,000 per farmer, \$35,000 per miller

IMPACT FOR BAKERS

71% reported increased use of local grains — 36% developed new products — 86% made new contacts — estimated average \$5-20,000 economic business gain

JANA KRAFT, PROJECT INVESTIGATOR

A Healthy Cow is a Healthy Vermont



Jana Kraft, Project Investigator

Dr. Jana Kraft is an Assistant Professor in the Department of Animal and Veterinary Sciences at the University of Vermont. Dr. Kraft's research is at the interface of animal science and human nutrition. Lipids are a group of naturally occurring molecules that include fats, waxes, sterols, fat-soluble vitamins, monoglycerides, diglycerides, triglycerides, phospholipids, and others. The overall objective of Dr. Kraft's research program is to gain a better understanding of how lipids, and bioactive fatty acids influence established and emerging risk factors and are linked to Metabolic syndrome, which is a combination of medical disorders that increase the risk of developing cardiovascular disease and diabetes.

There is a growing interest in the development of value-added (functional) milk and dairy products to maximize the contribution to health promotion and disease prevention. Because omega-3 fatty acids have been recognized as nutrients of high biological value that impact health benefits, they represent promising feed supplements to enrich functional components in milk and dairy products.



Photo credit: Branislav Pudar

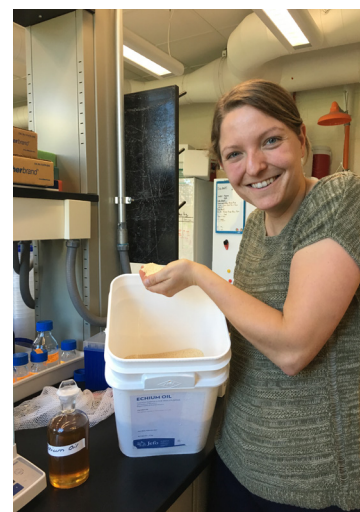
Healthier Milk

Adding fats to a cow's diet creates healthier milk. Cows are fed natural fats from Echium oil to produce milk that is higher in healthy fats. The added nutritional value in the milk fat can help prevent disease and lead to overall better health.



Milk cans hang and wait for next yogurt processing date at Butterworks Farm in Westfield, Vt.

Research results help cows be healthier. Feeding cows natural fats from Echium oil adds extra nutritional value which makes the cows healthier and saves farmers money on veterinary expenses.



Melissa Bainbridge, Ph.D. student working with Echium oil which is added as a natural supplement to cow feed.

Keeping Vermont Produce Safe From Farm to Table

Consumers, growers and retailers all want assurance that Vermont's fruits and vegetables have been produced using appropriate food safety practices. The Food Safety Modernization Act (FSMA), a federal law, requires large-scale growers to adopt a suite of food safety practices. The law also leaves small and medium-sized growers without food safety credibility in the marketplace.

To fill this need, University of Vermont Extension and the Vermont Vegetable and Berry Growers Association (VVBGA) have been collaborating since 2014 to develop practical, affordable and innovative Community Accreditation for Produce Safety (or CAPS) to meet the needs of Vermont's medium and small diversified produce farms. Accreditation will reassure consumers and retailers that fresh, local fruits and vegetables are produced using best practices to minimize food safety risk.

CAPS builds on food safety awareness and planning fostered by several years of Practical Produce Safety education led by the UVM Extension Center for Sustainable Agriculture (CSA). CAPS brings consistency to plan development and a means for determining whether practices have been adopted. The program is a unique community-based approach to food safety; it is designed by farmers and allows them to share their best practices online. CAPS has generated a lot of farmer buy-in, and retailers have shown support for the program by committing funds for its development. Donors include Black River Produce, City Market, Hanover Food Co-op, and Middlebury Food Co-op, as well as the High Meadows Fund and the Castanea Foundation.

As a result of the combined efforts of the CSA's Practical Produce Program and CAPS program, over 70 growers have written produce safety plans for the first time (assisted by an extensive practical produce safety manual and hands-on workshops). And 95 growers have signed onto the online CAPS platform completing their farm's produce safety self-assessment. These growers represent 1,729 acres of vegetable production, with an estimated value of \$9.45 million in annual sales. As adoption of CAPS increases in the coming years, thousands of acres of vegetables, worth tens of millions of dollars, will be sold to consumers with the added assurance that good food safety practices were used to grow them.

Twenty-three farms across the state piloted the accreditation system in 2015. They tested the accreditation policies and procedures developed by UVM Extension and the CAPS advisory board, and approved by the entire VVBGA Board. In 2016, improvements will be made and then CAPS accreditation will be offered to all 350 member farms of the VVBGA. Seventy-five farms are expected to complete the process this year, increasing to 150 farms in 2017.



Grower participation in CAPS will help further reduce the already low risk posed by locally grown produce, demonstrating the commitment of Vermont farmers to quality and accountability. (Photo: Hans Estrin)

10 Things to Know About CAPS

-  Voluntary (not regulatory) food safety accreditation program
-  For small-/medium-sized diversified produce farmers
-  Builds on "Practical Produce Safety" planning program
-  Advisory Board includes farmers, VVBGA, Vt. Agency of Agriculture, Vt. Department of Health, produce distributor
-  Specifies 18 required food safety accreditation practices
-  An online system for plan writing, implementation, tracking, documenting food safety risk reduction practices
-  Advisory Board reviews each farm plan before granting accreditation
-  Community-based: designed by farmers, supported by retailers
-  Practical and affordable accreditation

<https://practicalproducesafetyvt.wordpress.com>



Advisory Boards

VERMONT AGRICULTURAL EXPERIMENT STATION

Tom Berry, Colchester; Megan Camp, Shelburne; David Dunn, Queensbury, N.Y.; Robert Foster, Weybridge; Leon Graves, Marcellus, N.Y.; Patricia Heffernan, Shelburne; Peter Karnezos, Colchester; Meghan McKeown, Seattle, Wash.; Ryan McLaren, Burlington; Jenny Nelson, Ryegate; Mariah Noth, Grand Isle; Robert Paquin, Shelburne; Chuck Ross, Hinesburg

UVM EXTENSION

Ray Allen, South Hero; Tom Berry, Colchester; Joe Buley, Montpelier; Patricia Coates, Jericho; Maree Gaetani, Stowe; Jean Hamilton, Plainfield; Dyani Jones, Jericho; Beth Kennett, Rochester; Darren Kerr, Middlebury; Ryan McLaren, Burlington; Jenny Nelson, Ryegate; Suzi Pike, Stowe; Katherine Sims, Westfield; Steven Sinclair, Montpelier; Catherine Thrasher, Rupert

Credits

CONTRIBUTORS & PHOTOGRAPHERS;

Carey Austin, Will Ball, Conor Banfield, Brian Beckage, Lauren Becker, Champlain Valley Crop, Soil and Pasture Team, Zach Chernick, Cindy Corkins, Melissa Cronin, Gary Deziel, Stephanie Dion, Cheryl Dorschner, Hans Estrin, Richard Fanus, Loren Fillmore, Kate Finley-Woodruff, Vern Grubinger, Sarah Heiss, Thomas Hobbs, Stephanie Hurley, Iowa State University Extension and Outreach, Hannah Kearns, Jeanne Keefe, Jana Kraft, Sue Lang, Doug Lantagne, Dan Lerner, Kathleen Liang, Robin Lockerby, Chandler Loyd, Ernesto Mendez, Georgia Mulone, Olivia Mueller, National 4-H Council, Jane Nevins, Ginger Nickerson, Northwest Crops and Soils Program, Todd Pritchard, Sarah Sapirstein, Katy Silber, Robin Smith, Jack Turnbaugh, Lauren Traister, Diane Trono, Tom Vogelmann, Audrey Williams, Cathy Yandow.

Vermont Agricultural Experiment
Station
Thomas Vogelmann, Dean
Thomas.Vogelmann@uvm.edu

Morrill Hall, UVM
146 University Place
Burlington, VT 05405-0106
802-656-0137



UVM Extension
Douglas Lantagne, Dean
Doug.Lantagne@uvm.edu

23 Mansfield Avenue
Burlington, VT 05401-3323
802-656-2990, 1-866-622-2990

