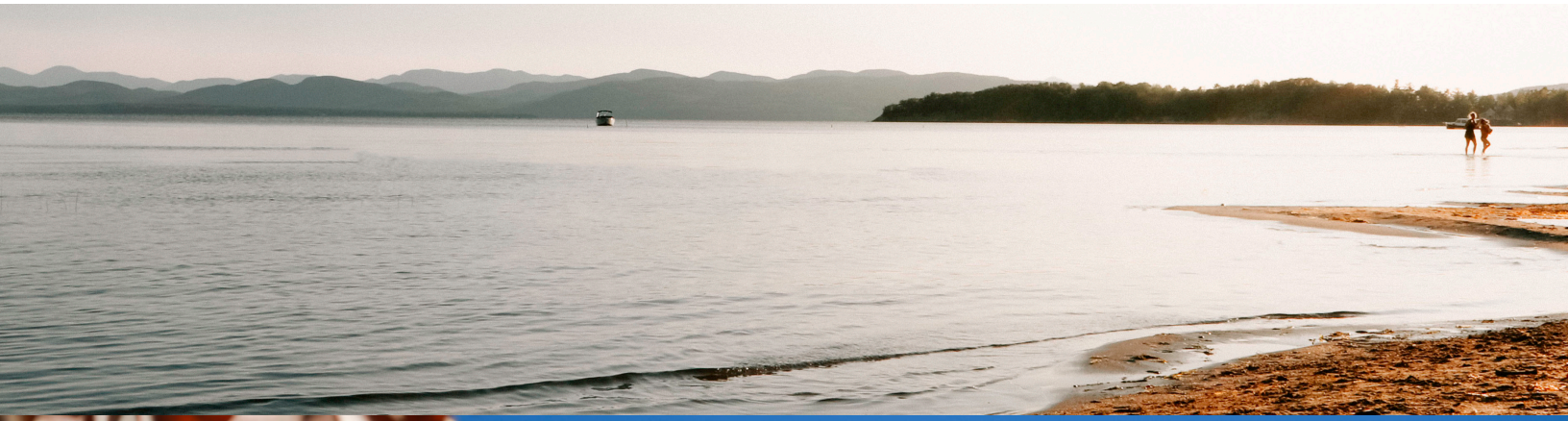
2019 Annual Report

RESEARCH • IMPACT

THE UNIVERSITY OF VERMONT
AGRICULTURAL
EXPERIMENT STATION

THE UNIVERSITY OF VERMONT
EXTENSION



The University of Vermont

February 2020

Greetings from the College of Agriculture and Life Sciences!

We are pleased to share the 2019 Annual Report that provides an overview of CALS research and Extension outreach activities.

These activities address societal issues in agriculture, environment, nutrition, food safety, health, and youth, community and economic development. Work is conducted by experts in basic and applied life sciences, in campus labs and offices, at UVM research centers, and at farms, forests and fields throughout Vermont. Findings become evidence-based education and solutions to address problems faced by both rural and urban Vermonters.

In particular, UVM has been recognized for its leadership in sustainable agriculture and nutrition. As a result, CALS is partnering with USDA's Agricultural Research Service to host the first food systems research station. This research station will study diversified food systems and small farms, expanding knowledge in these areas and allowing other regions to benefit from it.

Visit our websites (*www.uvm.edu/cals* and *www.uvm.edu/extension*) to learn more about how our work continues to make a positive impact in the lives of Vermonters and others beyond our borders.

With best regards,

Jean Harvey
Interim Dean

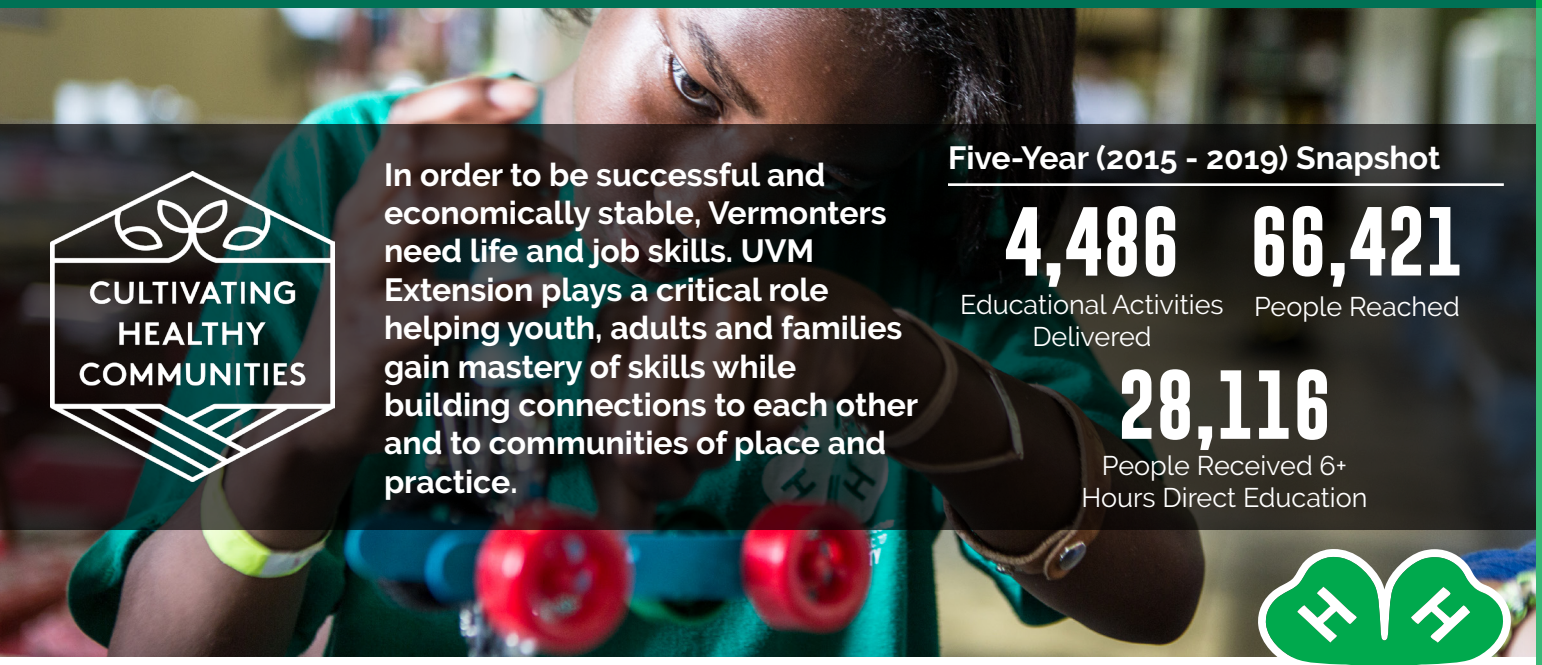
College of Agriculture and Life Sciences
Morrill Hall, 146 University Place, Burlington, VT 05405-0106
802-656-0137
calsdean@uvm.edu · www.uvm.edu/cals

Table of Contents

Acknowledgements:
Stephanie Albaugh, Jean Harvey, Emily Hellman, Dan Lerner, Rachel Leslie, Mary Peterson, Chuck Ross, Marcus Tracy, Cathy Yandow

THE UNIVERSITY OF VERMONT EXTENSION

IMPACT 4-H, YOUTH & FAMILIES



CULTIVATING HEALTHY COMMUNITIES

In order to be successful and economically stable, Vermonters need life and job skills. UVM Extension plays a critical role helping youth, adults and families gain mastery of skills while building connections to each other and to communities of place and practice.

Five-Year (2015 - 2019) Snapshot

4,486 Educational Activities Delivered

66,421 People Reached

28,116 People Received 6+ Hours Direct Education

EXPERTISE

4-H helps young people make healthy choices, build positive relationships, develop transferrable (life and job) skills, and explore areas of interest in safe, supportive environments. UVM Extension provides experiential learning opportunities through activities such as 4-H Clubs, Teen Science Cafés, and Teens Reaching Youth (TRY) for the Environment.

Family and Wellness programs reinforce the belief that healthy people and families are the foundation of Vermont communities. UVM Extension partners with agencies/organizations to provide education strengthening family relationships, wellness and parenting skills. Offerings include Coping with Separation and Divorce (COPE), PROSPER Drug and Alcohol Prevention and EFNEP Nutrition Education.

95%

Graduating high school seniors from 4-H Club programs believe 4-H helped them get into college

743

Youth demonstrated mastery of transferrable skills in 2019

1,165

Adults believe COPE positively impacted their parenting in 2019

MISSION

Provide and facilitate research, education and outreach with our partners for the people of Vermont.

www.uvm.edu/extension

THE UNIVERSITY OF VERMONT
AGRICULTURAL
EXPERIMENT STATION

RESEARCH

GARLIC ON BROCCOLI: A SMELLY APPROACH TO REPEL A MAJOR PEST

Measuring just two millimeters in length, the swede midge is a tiny fly that has become a major problem for vegetable growers in Canada and the Northeastern U.S. (Photo: Jorge Ruiz-Arocho)

Agricultural insect pests seek out familiar scents to find their plant hosts. However, they can also be repelled by odors from other plant species.

A recent study from UVM Associate Professor Yolanda Chen and former Ph.D. student Chase Stratton offers a novel framework for exploiting plant odors to repel insect pests. The study is the first to show how the similarity of plant odors and phylogenetic relatedness can predict insect repellency.

The team applied this conceptual framework to swede midge, a tiny fly that is becoming a major problem for growers of broccoli, kale and other cabbage-family crops. They found that particular essential oils – garlic, spearmint, thyme, eucalyptus lemon, and cinnamon bark – were most effective at repelling the midge. The findings come as good news to organic farmers who are without an effective solution for managing the pest.

Swede midge is a recent invader on vegetable farms in northern Vermont, as well as parts of Canada and New York. Midge larvae must feed on the brassica plant family in order to survive, which includes many popular vegetables like broccoli, kale, cauliflower, cabbage, Brussels sprouts, kohlrabi and collards.

Making a mistake and laying eggs on the wrong plant would result in the death of the midge's offspring.

The larvae "hijack the plant's control system" resulting in distorted growth, such as headless broccoli and cauliflower, puckered leaves, and brown scarring. Unfortunately for farmers, the damage is not observable until it's too late and the midge have already dropped off the plant. In areas where the midge has become well established, the midge can cause 100 percent crop losses.

To manage the midge, conventional growers have turned to neonicotinoid insecticides, which have been implicated in honeybee decline. With no methods for killing the pest, some organic farmers have simply stopped growing vulnerable brassica crops. This led Chen to explore new control options for organic farmers.

While essential oils have long been used in pest management, determining which oils are effective has followed a "trial by error" approach, says Chen. The study suggests a sustainable solution for this new invasive pest and provides a novel framework for testing pest management strategies in other species.

THE UNIVERSITY OF VERMONT EXTENSION

IMPACT AG BUSINESS

CULTIVATING HEALTHY COMMUNITIES

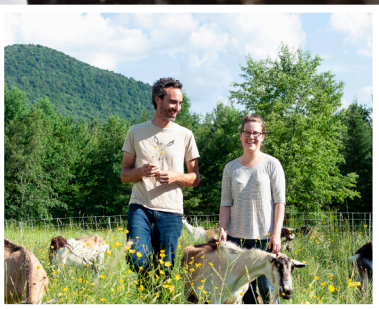
Vermont's farm and forest business sector is key to Vermont's identity. UVM Extension is committed to supporting a thriving agricultural economy through education and technical expertise designed for specific needs of farmers and producers.

Five-Year (2015-2019) Snapshot

7,144 Total Direct Participants

302 Educational Activities Delivered

1,410 People Received 6+ Hours Direct Education



EXPERTISE

Farm Business provides individualized business planning assistance to 50 farms each year. This holistic business analysis focuses on finances, market assessment, strategic plan development, and change implementation. Individualized farm plans integrate owner goals, business performance and conservation practices to sustain viable Vermont farms. Efforts include Water Quality Business Analysis.

Maple Business and **Forest Business** develop business education resources, conduct applied economic research, and provide business coaching to support Vermont's forest-related industries. Offerings include the Maple Benchmark publication, and Maple Economics workshops and Business Skills for Logging Professionals seminar.

Business coaching, financial analysis and support preparing plans result in new investment in Vermont's farm and forest businesses:

$1.4M
Invested in businesses participating in the 2018-19 Farm Viability program

$3.9M
Invested in infrastructure improvements for participants in the Water Quality Business Analysis program

$1.9M
Invested in Vermont forest and maple businesses participating in the Maple and Forest Benchmarks project

MISSION

Provide and facilitate research, education and outreach with our partners for the people of Vermont.

www.uvm.edu/extension

THE UNIVERSITY OF VERMONT
AGRICULTURAL
EXPERIMENT STATION

RESEARCH

USING MACHINE LEARNING AND AI TO SUSTAINABLY FEED THE WORLD

Photo: UVM Extension Northwest Crops & Soils Program

Researchers at the University of Vermont have teamed up with scientists around the U.S. to tackle agriculture's grand challenge of feeding the world's growing population while conserving natural resources and reducing its environmental footprint. Using precision agriculture tools, network analysis, artificial intelligence and machine learning, the project will analyze cover cropping strategies at over 100 farms throughout the East Coast and Midwest and survey farmers and advisors across 20 states with the goals of improving profit for farmers and building more sustainable food systems.

The five-year project has been awarded $10 million from the USDA Agriculture and Food Research Initiative (AFRI)'s Sustainable Agricultural Systems program. UVM Extension Professor Heather Darby and UVM Food Systems and Department of Nutrition and Food Sciences Assistant Professor Meredith Niles both serve on the project's executive committee.

"This is really taking the research and knowledge that we have and being able to deploy it on hundreds and hundreds of farms across our region," said Darby who will be leading on-farm trials at 10 different sites in Vermont starting in the late summer of 2020.

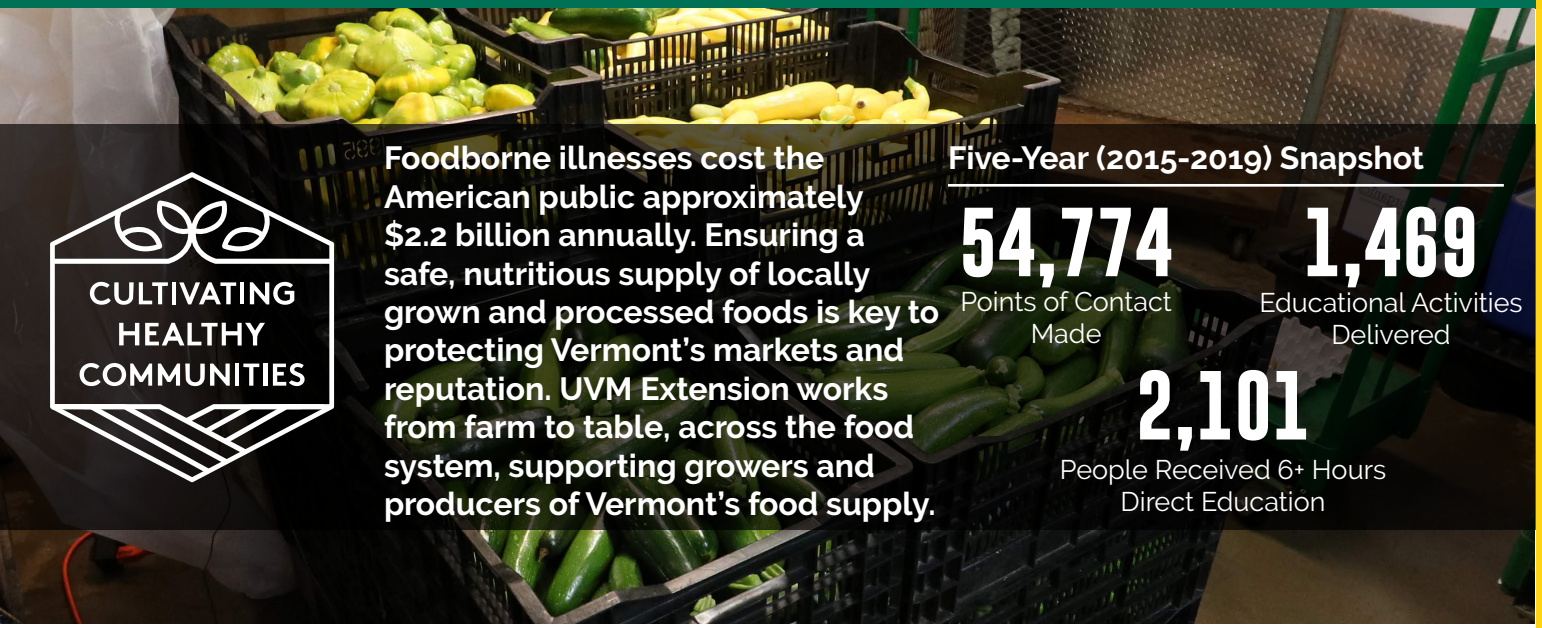
Combining cover crops with sustainable agricultural practices like reduced tillage, diversified crop rotations and integrated weed management can increase soil health, allowing for more climate-resilient production of food and fiber and greater yields for farmers. However, cover cropping strategies may vary depending on weather, climate and growing conditions.

Advances in sensor technology, on-farm monitoring systems and cloud-based platforms have enabled massive amounts of data to be collected in real time. The research team will deploy these technologies across its 100 field trial sites and use machine learning and artificial intelligence to begin to predict optimal strategies for farmers based on their crop and environmental conditions.

"We're developing decision support tools that will take the data and make it palatable for farmers. That's who we're doing this work for," said Darby.

THE UNIVERSITY OF VERMONT EXTENSION

IMPACT FOOD SAFETY



CULTIVATING HEALTHY COMMUNITIES

Foodborne illnesses cost the American public approximately $2.2 billion annually. Ensuring a safe, nutritious supply of locally grown and processed foods is key to protecting Vermont's markets and reputation. UVM Extension works from farm to table, across the food system, supporting growers and producers of Vermont's food supply.

Five-Year (2015-2019) Snapshot

54,774
Points of Contact Made

1,469
Educational Activities Delivered

2,101
People Received 6+ Hours Direct Education

EXPERTISE

Food Safety for Processors improves the safety of manufactured foods by training, certifying, and consulting with small- to large-scale food processors. UVM Extension offers trainings like *Preventative Control for Human Food*, and *Hazard Analysis and Critical Control Points (HACCP)*, to ensure compliance with industry-driven food safety certifications, and state/federal regulations.

Food Safety for Producers includes technical assistance, on-farm education, grower training, safety improvements implementation, and certification through the *Community Accreditation for Produce Safety (CAPS)* program. Much of this work is done in partnership with the Vermont Agency of Agriculture, Food and Markets.

Northeast Center to Advance Food Safety (NECAFS) is a collaborative, regional effort hosted at UVM Extension. The Center advances understanding and practice of improved food safety among the region's small and medium sized produce growers and processors.

$21.8M
Estimated annual sales of fresh produce from **125** farms enrolled in CAPS in 2019

4,291
Participants in **503** trainings provided by *The Northeast Center to Advance Food Safety (NECAFS)*

19
Food manufacturers – like *Vermont Bean Crafters* and *Bove Brothers* – realized benefits after consulting with UVM Extension's Food Safety Specialist in 2019

MISSION

Provide and facilitate research, education and outreach with our partners for the people of Vermont.

www.uvm.edu/extension

THE UNIVERSITY OF VERMONT
AGRICULTURAL
EXPERIMENT STATION

RESEARCH

MOOSE GENETICS OFFER NEW CLUES FOR WILDLIFE MANAGEMENT

Photo: Josh Blouin

Moose have been the subject of intensive study in recent years in the Northeastern U.S., largely due the growing problem of winter ticks that have had a negative impact on the region's moose population. Most research has focused on the links between landscape conditions and the survival and reproduction of moose.

Now, for the first time, researchers at the University of Vermont are using genetics to reveal new information about the health of moose and the state of moose populations.

Stephanie McKay, associate professor of animal and veterinary sciences, has been studying genetic characteristics of moose in Vermont to better understand their genetic diversity and how genes flow across the Northeastern landscape. Working in collaboration with wildlife biologist Jed Murdoch in UVM's Rubenstein School for the Environment and Natural Resources, she has found the region's moose population has very low genetic diversity, which may impact their ability to fight off winter ticks and reproduce.

Moose are believed to have crossed the Bering Land Bridge from Asia to North America some 15,000 years ago. As small groups of moose migrated east, they carried a limited amount of genetic information with them and did not reflect the diversity of the entire moose population, explains McKay. By the time moose arrived in Vermont, they may only have had other relatives to mate with.

"It's compounded inbreeding," said McKay. "The moose in Idaho are going to be a bit more inbred than the ones in Alaska. A couple of the moose in Idaho may have then moved up to Vermont."

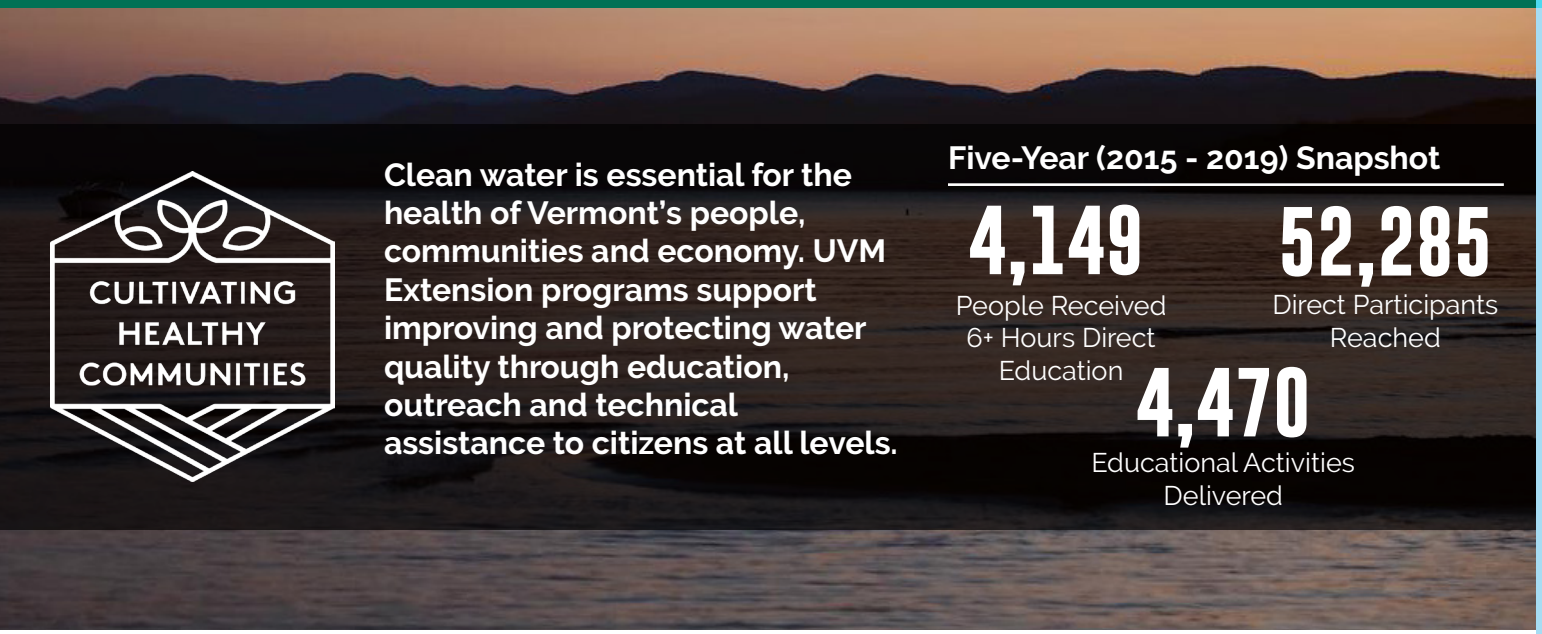
Still in the early stages of this research, McKay and Murdoch suspect the lack of genetic homogeneity can impact the moose's immune system and may reduce their ability to cope with high tick loads.

"What we've seen in recent years is that moose have continued to decline and much of that decline is due to the influence of winter tick which can accumulate on individual moose in really high numbers. There have been records in New Hampshire for example, of upwards of 90,000 ticks on an individual."

Having confirmed their suspicions of low diversity in the genome of Vermont moose, McKay and Murdoch are utilizing moose genetics to inform moose population management. "Vermont is the first state to be able to do that," said McKay.

THE UNIVERSITY OF VERMONT EXTENSION

IMPACT WATER QUALITY



CULTIVATING HEALTHY COMMUNITIES

Clean water is essential for the health of Vermont's people, communities and economy. UVM Extension programs support improving and protecting water quality through education, outreach and technical assistance to citizens at all levels.

Five-Year (2015 - 2019) Snapshot

4,149
People Received 6+ Hours Direct Education

52,285
Direct Participants Reached

4,470
Educational Activities Delivered

EXPERTISE

Soil Health and Conservation education and technical assistance help farmers implement best practices to decrease nutrient losses to surface water. UVM Extension encourages farmers to build healthy and resilient soils through *Nutrient Management Planning*, reduced tillage, and other conservation practices.

Grazing and Livestock practices have direct impacts on soil and water conservation. UVM Extension faculty and staff provide research, educational opportunities and technical support to enhance successful grass-based livestock production. Current efforts include *goGraze™*, Grazing Management course and the Center for Sustainable Agriculture's Pasture Program.

Watershed Outreach and Education provide critical research and outreach to Lake Champlain Basin residents, educational communities, and agency staff members. *Lake Champlain Sea Grant Institute* and *Watershed Alliance* engage these (and other) groups in learning about watershed science, land use planning, water quality, sustainable development and more.

1,268
Farmers implemented best agricultural practices improving crop/pasture, product, and/or soil productivity while protecting water, air, soil, and/or other natural resources (from 2015 to 2019)

50%
Reduction in water runoff using innovative grazing technique: woodchips in heavy-use livestock areas

714
Miles of road with reduced salt usage: *Sea Grant Road Salt Conference* attendees are changing their behavior and implementing best management practices

MISSION

Provide and facilitate research, education and outreach with our partners for the people of Vermont.

www.uvm.edu/extension